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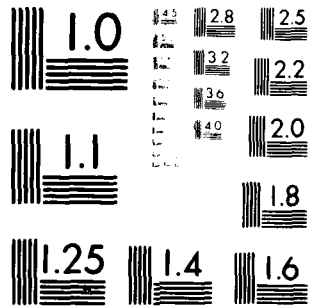
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CONARC TRAINING WORKSHOP
FORT GORDON, GEORGIA
5-7 OCTOBER 1971.

Sponsored by
US Continental Army Command

Hosted by
US Army Southeastern Signal School

9 Final Report, In Seven Volumes

CONARC 1971
5-7
VOLUME V.

Methods and Media Speciality Workshop.

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GENERAL RALPH E. HAINES, JR.

Commanding General

US Continental Army Command

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Approved for release;
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METHODS AND MEDIA SPECIALTY WORKSHOP

CONTENTS

1. Names and Addresses of Key Personnel.....	V-1
2. Executive.....	V-4
3. Specialty Workshop Schedule.....	V-6
4. Overview and Opening Remarks.....	V-8
5. Biographical Sketch - Dr. Leslie J. Briggs.....	V-16
6. Theoretical Framework of Methods and Media Within The Instruct- ional System.....	V-18
7. Theoretical Framework in Using Matrices in Selection of Media and Methods.....	V-27
8. Experience with Methods and Media Selection at the U.S. Army Missile and Munitions School.....	V-32
9. Experience in Methods and Media Selection at the U.S. Army Southeastern Signal School.....	V-44
10 Workshop Session #1 Discussion.....	V-92
11 Perspectives in Simulation and Miniaturization.....	V-99
12 Combined Arms Tactical Training Simulator (CATTs).....	V-119
13 Individual Learning Center at the Infantry School.....	V-143
14 Multi-media Centers in the U.S. Navy.....	V-151
15 USAF Approach to the Learning Center.....	V-155
16 Group Activity Related Learning Centers.....	V-164
17 Cost Effectiveness and Problems of Comparative Effectiveness of Methods and Media.....	V-169
18 Problems and Research Findings in Relation to Methods and Media Effectiveness and Cost Effectiveness of Media.....	V-176
19 Summary of Sessions on Methods and Media.....	V-178

METHODS AND MEDIA SPECIALTY WORKSHOP

Names and Addresses of Key Personnel

Chairman: KNEISEL, Mr. Richard S.
Special Assistant - Educational Advisor
US Army Infantry School
Fort Benning, Georgia 31905

Resource Consultant: BRIGGS, Dr. Leslie J.
Department of Educational Research
College of Education
Florida State University
Tallahassee, Florida 32306

Participants:

AMOS, CPT Albert R., Jr.
CATTS Project Officer
Brigade and Battalion Operations
Department
US Army Infantry School
Fort Benning, Georgia 31905

DAVISON, Mr. Vaughn E.
Educational Advisor
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KENNEDY, CPT Terence J.
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Office of the Director of Instruction
US Army Infantry School
Fort Benning, Georgia 31905

LAKEMAN, Mrs. Doris D.
Instructional Methods Division
Office of the Director of Instruction
US Army Southeastern Signal School
Fort Gordon, Georgia 30905

McCLUSKEY, Mr. Michael R.
Work Unit Leader, MARKSMAN
HumRRO Division No. 4
P. O. Box 2086
Fort Benning, Georgia 31905

Participants: (Continued)

MENCKEN, Mr. Albert H.
Chief, Instructional Methods Division
Office of the Director of Instruction
US Army Southeastern Signal School
Fort Gordon, Georgia 30905

SMITH, Dr. Edgar
Media Specialist
Air Force Human Resources Laboratory
Air Force Systems Command
Lowry Air Force Base, Colorado 80230

SPANGENBERG, Dr. Ronald W.
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HumRRO Division No. 2
Fort Knox, Kentucky 40121

STANFIELD, MAJ Howard S.
Instructional Methods Division
Office of the Director of Instruction
US Army Infantry School
Fort Benning, Georgia 31905

STODDARD, Mr. Raymond
Director, Education and Training Support
Detachment
Naval Base
Charleston, South Carolina 29408

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EXECUTIVE SUMMARY OF WORKSHOP SESSION
METHODS AND MEDIA SPECIALTY AREA
CONARC TRAINING WORKSHOP
5-7 October 1971

by

Richard S. Kneisel, Education Advisor, USAIS

Dr. Leslie J. Briggs, Department of Educational Research, Florida State University, established theoretical and practical considerations in use and selection of methods and media by using his concept for developing his own course in the design of multimedia. He outlined a very practical catalog of the types of considerations a person may go through in selecting methods and media. This catalog of actions included the following: when to make the media selection in designing the instructional system; what is the context within which the course is to be designed; criteria or rationale one has in mind when selecting media; type of stimuli or learning mode involved; design criteria, i. e. minimum performance to be accepted; possible use of checklist to match media and methods with characteristics of learning; ease of presentation management and executive decisions as to comparative effectiveness and trade offs of methods and media.

HumRRO Division No. 2 presented some concepts and ideas that focused on the role of the course designer in the methods and media solution as opposed to the instructor being involved. US Army Missile and Munitions School outlined its procedure for use of a scheme for selection of media, methods and training aids in the systems engineering process. The US Army Southeastern Signal School showed by a practical application the use of its matrix for selecting methods and media in the design of courses. Discussion of these theoretical and practical considerations revealed that, while each training establishment may have its own special problems and requirements for specific approaches, the matrices and considerations for media selection are extremely valuable aids for course designers and instructors.

HumRRO Division No. 4 presented some theoretical and yet basic concepts in the development and use of miniaturized systems simulation and simulators. A model for the development of simulation was given. Examples of the Laser Beam Rifle and target simulators were discussed. The US Army Infantry School presented its concept and the developmental actions resulting in a simulation system for Air Mobile Command and Control Simulators and for a Combined Arms Tactical Training Simulator.

The development of, use of, and problems associated with learning centers and multimedia centers were discussed from the Army, Navy, and Air Force perspective. The US Army Infantry School outlined its

actions in establishing its Individual Learning Center and demonstrated one of its learning carrels. Representatives from Charleston Navy Base and Air Force Systems Command outlined what the Navy and Air Force have done and are doing with multimedia centers and learning centers, giving in the process extremely valuable practical examples of on-going systems in their services.

Air Force Systems Command provided a strong base of information with regard to the problems of, and considerations in, the cost effectiveness and comparative effectiveness of methods and media. It was shown that since the comparative effectiveness of various media and methods is a complex problem studies in the past have resulted in erroneous information about cost effectiveness. Some possible solutions and alternatives with regard to cost effectiveness were presented.

Some basic issues to be addressed that derived from the Methods and Media Workshop sessions were:

1. In the selection of methods and media the total system and complete instructional design must be considered.
2. There is a tendency in the systems engineering process by the course designer to read the instructor out of the developmental process.
3. There is a requirement for more research in simulation and requirement to address simulation at the lower trainee level on a much broader and less costly basis.
4. There is a requirement to use more effectively individual learning centers and multimedia centers.
5. Consideration in the future needs to be given to bringing the training to the learner rather than the learner to the training.
6. There is a tendency in the systems approach in the military for the system to be too big and not responsive to the trainer.
7. Accountability needs to be looked at not purely as cost effectiveness but as cost benefits.
8. There is a possibility that in some instances it may be cheaper for OJT than for school training.
9. Media and methods "tails sometimes wag training dogs."

Specialty Workshop Schedule

for

METHODS AND MEDIA

Location and Capacity: Studio B, Nelson
Hall, 40 persons

Civilian Consultant: Dr Leslie J. Briggs
Florida State Univ

Chairman: Mr Richard S. Kneisel
Educ Advisor, USAIS

Room Monitor: Mr Albert H. Mencken
Ch, IND, USASESS

SESSION NO. 1 -- Some Theoretical and Practical Considerations in Methods and Media

5 Oct 6 Oct

1400-1410 1400-1410 Objectives for Methods and Media Sessions -- Mr Kneisel, USAIS
1410-1440 1410-1440 Theoretical Framework of Methods and Media Within the Instruc-
tional System -- Dr Briggs, Florida State University
1440-1520 1440-1520 Panel Presentation on Methods and Media Selection:
Theoretical Framework -- Dr Spangenberg, HUMERO
Experience at USAMICS -- Mr Davison, USAMICS
Experience at USASESS -- Mrs Lakeman, USASESS
1520-1530 1520-1530 Discussion -- Mr Kneisel, USAIS (Discussion Ldr)

SESSION NO. 2 -- Miniaturization, Simulation, and Simulators

5 Oct 6 Oct

1550-1610 1550-1610 Miniaturization, Simulation, and Simulators; Laser Beam Rifle
and Target Simulators -- Mr McCluskey, HUMERO
1610-1635 1610-1635 Large Area Simulation; Combined Arms Tactical Training Simulator
-- CPT Amos, USAIS
1635-1700 1635-1700 Discussion -- Mr Kneisel, USAIS (Discussion Ldr)

SESSION NO. 3 -- Learning Centers

6 Oct 7 Oct

0830-0845 0830-0845 Individual Learning Center (Inf Sch) -- MAJ Stanfield, USAIS
0845-0900 0845-0900 Multimedia Center (Navy) -- Mr Stoddard, Charleston Nav Base
0900-0915 0900-0915 Learning Centers (Air Force) -- Dr Smith, Lowry AFB
0915-1030 0915-1030 Group Activity -- Mr Kneisel, USAIS (Moderator)

**SESSION NO. 4 -- Cost Effectiveness and Problems of Comparative Effectiveness of
Methods and Media**

6 Oct 7 Oct

1100-1125 1045-1110 Cost Effectiveness; Methods and Media Effectiveness -- Dr Smith,
Lowry AFB
1125-1155 1110-1140 Problems and Research Findings -- Mr Kneisel, USAIS (Discussion Ldr)
1155-1215 1140-1200 Summary of Sessions on Methods and Media and Reactions of the
Audience -- Mr Mencken, USASESS

WORKSHOP SESSION NO. 1

**SOME THEORETICAL AND PRACTICAL
CONSIDERATIONS IN METHODS AND MEDIA**

Overview and Opening Remarks
METHODS AND MEDIA SPECIALTY AREA

by

Richard S. Kneisel, Education Advisor, USAIS

We plan to conduct the Methods and Media Specialty Area sessions as a means of exchange, interaction, and reaction. This is one of our major objectives. Knowledge and information is another. We want to surface some ideas, concepts, and issues related to these four workshop sessions which have been called Methods and Media.

We can open the door a crack on some of the theoretical concepts and get our feet wet in some of the methods and media ponds--or perhaps swamps--of the real world you all live in and train in. What comes out of these four workshop sessions is largely dependent on each of you--the participating audience.

It is my hope that these four sessions--while in some instances may seem to be restrictive and perhaps incongruous in that, for example, they deal with learning centers and simulation--will provide a springboard to allow us to plunge into the entire field of methods and media. In a group of this size the talent and experience is unlimited--and hence we plan to use it to the advantage of each of us.

As indicated in my opening remarks in Alexander Hall there will be four sessions each, conducted twice on different days. The first workshop session for Methods and Media will start off with some theoretical considerations--our Resource Consultant, Dr. Leslie J. Briggs will set the framework of theoretical considerations. He will be followed by a type of panel presentation of HumRRO and service school representatives giving their experiences in selecting methods and media in the systems engineering of training--course design.

→ The second session will be devoted to some theoretical and practical concerns in miniaturization, simulation, and simulators. Examples from the field will be given by HumRRO and the Infantry School.

→ The third session will be devoted to the Army, Navy, and Air Force's experiences in learning centers and multimedia centers, with an opportunity to break into three groups for some close-in action.

→ The fourth and final session will be on cost effectiveness and comparative effectiveness of media and methods.

✓ To help structure the discussion and your audience participation, we have made up some summary sheets with some questions to your cognitive processes and maybe even your affective processes. Please use these sheets as a guide (Inclosures 1 - 4). Also, there is an evaluation sheet (Inclosure 5) which we hope will provide positive feedback for both you and the managers and participants in the workshop. (NOTE: Summary of participant comments are listed on the evaluation sheet.)

Now, without further ado, let's get on with the workshop specialty session on methods and media.

CONARC TRAINING WORKSHOP
5 - 7 October 1971

METHODS AND MEDIA SPECIALTY AREA

**Workshop Session No. 1 - Some Theoretical and Practical
Considerations in Methods and Media**

1. During this session Dr. Leslie J. Briggs, Educational Research Department, College of Education, Florida State University, Tallahassee, Florida, will present some ideas about the theoretical framework of Methods and Media within the Instructional System. A panel of Dr. Ronald Spangenberg, HumRRO Division No. 2, Fort Knox Kentucky, Mr. Vaughn Davison, US Army Missile and Munitions School, Redstone Arsenal, Alabama, and Mrs. Doris Lakeman, US Army Southeastern Signal School, Fort Gordon, Georgia, will discuss concepts and schemes for media and method selection in the concept of system engineering of courses.

2. Remember there is to be discussion. Be prepared to react and interact. Some possible questions you might want to consider to help you in thinking through the workshop session are listed below.

- a. What is a method?
- b. What is media?
- c. Can methods and media be selected by a matrix?
- d. How can the systems engineer (course designer) select media?
- e. What is the instructor's role in media and/or method selection?
- f. Why do we not always consider both the presentation and feedback requirements in designing a learning program?
- g. What should be the functions of a classroom instructor in a Modern Army training program?
- h. Given a systems engineer who selects, organizes, and determines the way information will be provided the learner, who is the instructor?
- i. Does the learner determine the method or does the method or media determine the learning?

3. List below your own questions to discuss.

CONARC TRAINING WORKSHOP
5 - 7 October 1971

METHODS AND MEDIA SPECIALTY AREA

Workshop Session No. 2 - Miniaturization, Simulation and Simulators

1. During this session Mr. Mike McCluskey, HumRRO Division No. 4, Fort Benning, Georgia, will present some theoretical considerations for miniaturization and simulation. Some ideas on transfer and cost effectiveness will be given. Practical examples of target identification and laser beam rifle will be discussed. Captain Al Amos will discuss the US Army Infantry School's approach to a large area simulation, namely the Combined Army Tactical Training Simulator. Following this presentation there will be a discussion session.

2. Remember you can get more out of this session if you get involved. Be prepared to react, interact, and question. Listed below are some possible questions that we might want to discuss.

- a. What is the difference between a simulator and simulation?
- b. What are the main problems of miniaturization?
- c. Can simulation be effective if it has low fidelity?
- d. To what extent can simulation be used with low level trainees?
- e. How can simulation be used as an evaluator of performance?
- f. What is the most effective combination of simulated and real world experience?
- g. Can the Combined Arms Tactical Training Simulator be used for ground combat only?
- h. What is the cost of computer animation?

3. List your own questions below:

CONARC TRAINING WORKSHOP
5 - 7 October 1971

METHODS AND MEDIA SPECIALTY AREA

Workshop Session No. 3 - Learning Centers

1. During this two-hour session there will be approximately 45 minutes devoted to formal presentations from the Army, Navy, and Air Force on their experience with learning centers and multimedia centers. Major H. S. Stanfield will give the experience at the US Army Infantry School. Mr. Ray Stoddard will give Navy experience at Charleston Navy Base. Dr. Ed Smith will give an overview of what has happened and is happening in the various Air Force training establishments with regard to multimedia/learning centers.

2. Following these presentations all members of the audience will become involved in group activity relative to procedures and experiences of learning centers. Three groups will be formed with one of the three discussants in para 1 above being the resource person for the group. Groups will form up in equal numbers in three corners of the room. Groups will elect a chairman (not the resource person) and a recorder. After an hour of discussion and interaction the groups will break up and each group will report back to the total audience in Studio B its findings and items of interest.

3. The following are some of the questions which may afford a start of the interaction.

- a. What is the difference between a learning center and a multimedia center?
- b. What is the difference between a learning resource center and an individual learning center?
- c. How does a learning center get integrated into an on-going instructional system?
- d. What kinds of equipment are best for learning centers?
- e. Where is the best physical location for a learning center?
- f. What about living/learning centers?
- g. How does the concept of individualized instruction relate to learning centers?
- h. What are the best learning strategies for learning centers?

- i. How does "soft wear" fet developed for learning centers?
 - j. What is the use of CAI in learning centers?
 - k. What is the cost effectiveness of learning centers?
 - l. How does the concept of a volunteer service relate to learning centers?
4. The questions above are intended only as possible thought provokers. It is not necessary to form them in any order. Any questions are fair game. Make the small groups work for you and your problems.
5. A Learning Center carrel from the US Army Infantry School, Fort Benning, Georgia, is set up in the back of the room. Captain Terry Kennedy, the officer in charge of the USAIS Individual Learning Center, is in attendance and can offer some valuable practical experience.

CONARC TRAINING WORKSHOP
5 - 7 October 1971

METHODS AND MEDIA SPECIALTY AREA

**Workshop Session No. 4 - Cost Effectiveness and Comparative
Effectiveness of Methods and Media**

1. This fourth session of the Methods and Media Workshop is intended to be in a sense a wrap-up of the three previous sessions. The crux of the methods and media "game" is to get at effectiveness in learning. The cost trade-offs and the "gimmickry" concept need to be handled by Army trainers and training managers. During this session Dr. Edgar Smith, from Lowry Air Force Base, will give some ideas as a point of departure.

2. Following some of these preliminary ideas, the group will become involved in reacting to these ideas, presenting any research they are aware of and possibly pointing to the need for additional study. Listed below are some questions that may help stimulate your ideas and discussions.

a. How do media and methods come into being in an instructional system?

b. How do we know they (2a above) are the best methods and media?

c. When is a system cost effective?

d. How does the instructor influence the methods/media selection and how does he affect the effectiveness of the methods and media?

e. What research is available in cost effectiveness of media and methods?

f. What research would you propose in the area of methods and media?

3. List on the reverse side any additional questions you might want to discuss in this area of media/method effectiveness.

4. Following this cost effectiveness, comparative effectiveness discussion, Mr. Al Mencken, of the US Army Southeastern Signal School, will summarize the main points the four sessions devoted to methods and media.

CONARC TRAINING WORKSHOP
5 - 7 October 1971

EVALUATION SHEET

Methods and Media Specialty Area

1. Workshop Session 1 2 3 4 (Circle Appropriate No.)
2. List below your comments on the workshop session. Be specific as to whether the session was appropriate to your needs. Give any ideas you have that you feel will be helpful to the Chairman and to the sponsors of the Workshop sessions and the Workshop as a whole. List the strengths and weaknesses.

SUMMARY OF THE COMMENTS: (Fifteen participants had specific comments)

1. Involve as many other service schools as possible in the presentations.
2. Address how to initiate ideas for innovative training.
3. Need more chance for interaction and getting the conference participants involved.
4. Need a data bank on methods and media at CONARC level.
5. Appreciated the presence of Dr. Briggs; it would be useful to have him visit CONARC school commandants.
6. Need empirical justifications for how-to-do-it procedures in terms of effectiveness and costs.
7. There needs to be some commonality of terms and definitions since semantics seem to vary widely.
8. Too much emphasis on hard skills and not soft skills, particularly the addressing of attitudes.
9. Need more of a workshop approach to explore fully a few of the major issues.

BIOGRAPHICAL SKETCH

Dr. Leslie J. Briggs
Department of Educational Research
Florida State University
Tallahassee, Florida

Address: 1114 Wisteria Drive, Tallahassee, Florida 32303

Born: October 18, 1919; St. Joseph, Missouri

Married: Arvella English; August 31, 1941

Present Position: Professor, Department of Educational Research,
Florida State University, September, 1968

Former Positions:

Assistant Professor of Psychology, University of Hawaii, 1948-51
Research Psychologist to Chief, Fire Control Branch, Maintenance
Laboratory, USAF Personnel and Training Research Center, Lowry
Air Force Base, Colorado, 1951-57
Research Engineer, Maintenance Engineering Staff, Hughes Aircraft
Co., Culver City, California, 1957-59
Director, Instructional Methods Program, American Institutes for
Research, Palo Alto, California, 1959-67
Vice-President, Dymedia, Inc., Palo Alto, California, 1967-68

Education: B. S. in Education, Fort Hays Kansas State College, 1941
M. S. (Psychology), Fort Hays Kansas State College, 1942
Ph. D. (Psychology), Ohio State University, 1948

Military Service: Army of the United States, 1942-46; U. S. and Europe
(2 battle stars), Private to Techn. 4

Memberships:

Fellow, Divisions of Educational and Military Psychology, American
Psychological Association
Fellow, American Association for the Advancement of Science
Member, American Educational Research Association
Member, Division of Audiovisual Instruction, NEA
Member, American Academy of Political and Social Science

Licensing: Licensed Psychologist, State of California

Patents: (2) Teaching Machines

Leslie J. Briggs

Consultant to: U. S. Office of Education
Chance-Vought, Inc.
California State Personnel Board
Pacific Telephone Company; A T & T
American Association for the Advancement of Science
Southeastern Educational Laboratory
Pensacola Junior College

**Research Contract Project Director or Principal Investigator for Studies
Sponsored by:**

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U. S. Naval Training Devices Center
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U. S. Naval Academy
Chance-Vought, Inc.

Dr. Briggs has authored over 70 articles and publications.

Theoretical Framework of Methods and Media
Within the Instructional System

by

Dr. Leslie J. Briggs
Department of Educational Research
Florida State University
Tallahassee, Florida

I am not a stranger to the military. I spent directly eleven years with the military services--four years in the Army infantry during WWII, my specialty being as a machinegunner. So, I learned a bit about field training during those four years. Then a few years after WWII, I was associated with the Air Force Personnel and Training Research Center for seven years. There I got acquainted more with the technical training aspects of military training; mainly, electronic equipment maintenance training. So, because of those eleven years and indirect contacts since, I feel quite at home with you and I am glad to be here. I guess I am one professor who still thinks it patriotic to be in the Armed Forces.

Before I try to outline--as you realize, it will have to be a sketchy one--a few comments about the topic, I would like to just make a comment about my more recent work, to set the background. Also, I guess, just because I like to have my practice consistent with my theory, I would like to have had this a multimedia presentation. In fact, I did come to town with ten pounds of video tapes in my brief case; but, after more discussion of the purpose of the program, we decided that interaction is more important than the presentation so I left the video tapes in the hotel so that I can interact with you.

For the last three years in Florida State University I have been privileged to spend almost all of my time developing one course to the point where it would suit me and prove to be effective. This developing action has been a one-man rather than a team effort. As such, this has been at least a three-year effort to get just one graduate course and one graduate school operating according to theory. I think I have just about achieved that end.

Three years ago, when I first started teaching this course--it is called "Design of Multimedia Instruction"--I began with no resources (a classroom, chalkboard, and a piece of chalk). About the second time I taught the course, Gagne's Conditions of Learning was published and was available. About the third time I taught it, I had a few pages

of mimeographed handouts and some other things, so we had to thrash things out in class pretty much. But, right from the beginning, it was really a workshop orientation in the sense that the task of the student was to design a miniature course showing that he understood and could use what he learned about the Course Design and Multimedia instruction. So, starting from that point, with just a blackboard and a piece of chalk, as of the end of this summer--that is, as of the end of August--I have finally put together nine resources which together make a self-instructional, individualized graduate course in the Design of Multimedia Instruction. I'll simply name the nine resources which I hope will be made available as a package later. Some of them have been made available as individual products up to now.

There is, first of all, a series of three AIR monographs which some of you know about.

Monograph #2 is called the "Media of Instruction."

Monograph #3 is called "Sequence of Instruction."

Monograph #4, which is a package text for my present course, is called "A Handbook of Procedures for the Design of Instruction." This is the overall model which my students follow in their actual instructional design efforts.

Those are three written components, the third being more of a workbook than a textbook; that is, having more self-test practice exercises and so on. So--from the very beginning, the students chose a set of objectives which they were to develop into a multimedia course. My role was primarily to give them consulting help and to give them feedback on their efforts. Of course, the final acid test and real feedback was the trying out of their materials on students to get empirical data on their effectiveness. So, with these first three products, we gradually added others.

The fourth product for the course was a series of video tapes which I believe could be made available through Florida State University. These were done in the Instructional Television of Florida State University this summer. In addition to the video tapes there is a series of seven films on the teacher and programmed instruction which I had developed at AIR a few years ago. This summer the sixth product for the course, "Design of Multimedia Instruction," which I developed is a student guide so that rather than having class meetings to give directions to the students, the student guide used as an individualized basis, just takes the student from A to Z, through the course. The seventh resource is called "A Model of Student Performance" which is a published collection of some of the work done by my best students in the past three years which serves as an example for other students to follow in their design efforts.

Our eighth resource is the Conditions of Learning, by Gagne. Our ninth resource is a review of the literature on Learner Variables as they affect the choice of the media of instruction. Our tenth resource is the instructor.

So, with all of these prior nine resources available to present information, provide practice in self-testing, and so in, it is obvious that lectures are no longer a part of the program and that students take their student guide, choose the kind of development they wish to make, make appointments with the instructor for individualized guidance and consulting, receive feedback from him through each step in the design process and then finally give the acid test of trying out their materials with students.

One person in the room--Bill Freeman (of the US Army Infantry School)--went through this course about mid-stream. I believe that was before monograph #4 was even finished. In fact, I know it was since Bill contributed a special section to that monograph. That's what I have been up to for the last three years in getting this one graduate course lined up at Florida State University. So, you can see at home I am practicing what I preach by offering this completely individualized graduate-level course called "The Design of Multimedia Instruction." I could have brought any of these nine products here today, if it were my job to present information on media presentations to you for the whole afternoon. However, the present plan for the afternoon is clearly better since we will have several presenters and a chance for broader interaction.

Now, all I would like to do is simply make a few terse comments or sort of outline, which I guess could be termed a catalog of types of considerations one might go through in choosing the media and methods of instruction. So, I will simply give you a heading, make two or three comments about it, and go on to the next heading which is about the best we can do in the time limit.

Well, perhaps the first question, if you are designing a course of instruction, is: When do you make the media and methods selection? Clearly, under some people's procedures, that's the first step; that is, one who is in the publishing business decides to publish the textbooks before he starts out. One who is in the business of making films decides he will make a film. But, of course, from the point of view of multimedia instruction I recommend that one take several steps before he selects the media. Under the model of the procedure for the design of instruction, which I teach to my own students, they first, of course, state their own course objectives. Then they break these down into more detailed objectives somewhat a la Gagne's hierarchies of subordinate competencies to objectives. Then for each subordinate competency, they classify it into some category of learning. This could use Gagne's eight categories of learning. It

could use Bloom's Taxonomy. It could use others. But the purpose here is to get subordinate competencies of objectives and then classify and identify those as the type learning they require. The purpose of doing that, of course, is to ask what instructional events are needed to teach or to learn that type of competency. In my own course, I ask students to classify subordinate competencies according to Gagne's eight types of learning, then use materials that he and I list to identify the specific instructional events that you must accomplish for the learner to be successful. Under my instructional model you make a separate medium selection for each instructional event for each competency.

Here we've come down to the major difference between my own preferred procedure for selecting media and that of others; namely, that I put it much later in the design process than others, which means that I choose media in very small sizes. I choose media for very small chunks of instruction whereas other models would choose media for a much larger chunk. Anyway, the first question is: When in the design process does one choose his media?

In my opinion, most people choose media too early. So, I prefer to put media selection in the spot I just described so that a lot of analysis has been done before media are chosen.

So the first consideration in the outline for media selection then was where in the process of design do you choose your media.

And now on to the second consideration. The second category of comments I might raise is: What is the context within the course being designed? I mean, on one hand, something as broad as the national values and circumstances. That is, one foreign country might find it easier to buy textbooks than to train teachers. Another foreign country would find it capable of producing lots of instruction through television. Another foreign country would not have the capability of so doing. The whole national milieu is one aspect of the context of media choices which must be considered. Under this title of context what I ask my students to do before they select their media is simply to describe their assumed instructional environment. That means: Are you designing a course for a correspondence school, for formal classroom training, for on-the-job, for learning at home on an individual adult basis, or what? We described the assumed learning environment or the institutional background against which this course has to fit. It seems necessary to consider that before choosing media.

Up to this point I have commented really on three things. First, when in the overall design of instruction media selections are to come (and I have indicated that they come rather late in the design analysis process in my model). Second, I have indicated this brings

another characteristic of my model in to play and that is one chooses media for small instructional units rather than for large ones. Once each individual media choice is made, it may be that if the media happen to be identical for several components in a row, the same media can be used or some substitution can be made to simplify the administration and logistics of the instruction. And so, the second characteristic of my model is that media be chosen in a small size or chunk. The third category of my outline of considerations for media selection has to do with the contents of the assumed instructional environment. I think this heading may be: What are the criteria or rationale that one has in mind when he selects media? I would name here at least four focal points for developing rationale for media selection. The first one I would call the Task Variable. By this I mean the type of learning that the objective or the competency calls for. Second, I would consider the learner's characteristics. Is he an adult learner? Is he sophisticated with reading? Can you depend heavily on print, or do you have to depend heavily on non-print media? Third, the assumed learning environment which interacts with the objective and the learner characteristics. The fourth, of course, are practical considerations of what resources are available to you, what skills do you have available, what equipment and budgets are available to make the assumed environment realistic.

The fourth category of considerations of our media selection catalog might lead us to ask? With all these things in mind, how do you analyze your task or your subordinate competency to get to a choice about selection of media? Under this category I would list first the identification of the type of stimuli. I mean something here that some people mean by learning mode; other people mean by media. But here's what I mean simply: By type of stimuli, do you want the printed word, the spoken word, a still picture, a motion picture. Taking, for example, a decision being made for the spoken word, then just how do you want the spoken word presented? In a live lecture? In a type tape-recorded lecture? And so on. So, you can see I am using media very simply as the end physical delivery system used and the type of stimuli being the more general point. Obviously, once you've said the printed words, you have the choice of books or words written on the chalkboard or words printed on charts, and so on. So, the media form is not as important in that sense as getting the type of stimuli right--that is, being sure that printed words are appropriate is the more fundamental decision than whether you print the word on the chalk board or on a booklet. Ultimately, then, the media choice may be a convenience matter.

A second point in analyzing task or subordinate competency in relation to media needs is to eliminate non-qualifying media. Once you have said I want a type of stimuli that gives me, say, pictures and control of the student's attention to parts of pictures, that immediately suggests that static displays may not be as effective as dynamic

displays and immediately it gets you to thinking about something like either a live demonstration, a televised demonstration, or a motion picture demonstration rather than static print in a book. It is these kinds of factors that ultimately get you the media choice. Basically, once you have identified the type of stimuli (like print, spoken word, still pictures, motion pictures, or real objects) then you have eliminated media which does not satisfy that type of stimuli. Then you can consider the remaining media and make a choice among them.

In making a choice of media for a whole sequence of instruction, I would suggest that one try to change the medium often enough to avoid boredom, but use a single medium long enough for practicality and efficiency in the classroom application. On the one hand a change of medium is good probably for breaking up boredom but on the other hand one would not want to change medium every thirty seconds. It would be too administratively cumbersome.

In my mode, the final choice of media considers what the media choice was for the adjacent steps in instruction and then makes the final choice in consideration with the tentative choices for preceding and following events. The ultimate aspect is a trade-off packaging decision by always selecting some medium that would provide the type of stimuli indicated. I consider the type of stimuli as the more fundamental classification than the particular medium for presenting that type of stimuli.

Now, quickly and more briefly, under other categories of consideration one, of course, deals not only with type of stimuli but with student response and feedback. So, one of the things one must evaluate carefully is considering the nature of the task; that is, is this objective a memory objective, a problem solving objective, or just learning to understand the concept? Considering the nature of the task and the characteristics of the learner, how often do I have to have him respond in some way so that he can receive feedback? That is a very important consideration in choosing media. And it doesn't exclude as many media as one might think, because our conventional uses of most media could make much more use of student responding and feedback than we usually do. For example, in the video tapes that I would have shown you had we not decided against it, you would find that in each video tape there is first the behavioral objective stated; then there is the presentation of the program itself; then at the end are test questions asked allowing time for the student to respond; and, then after each student response, the feedback and correct answer is supplied. All of this is within the ITV medium. Here instructional television is used not only to provide the type of stimuli desired but also to require the student to respond and to provide the opportunity for feedback. Such concepts as this make a more creative use of that TV medium than we too often see when it

is used as a video tape recorded lecture.

Another factor I would mention in choice of media are the design criteria; that is, when you first stated your objectives of your course, what was the minimum performance you set as acceptable performance for the students? Moreover, even with the same objectives, there may be different standards which you might require that might lead you to different media, because some media require more frequent student responding or frequent feedback; and, thus make more likely a higher ultimate level of performance. Let's see if I can put this in perspective: if you have (and the military, I know, often makes this distinction) to distinguish between familiarization training and skill training, you will find that familiarization training is not as demanding in the terms I am using here as skill training. Therefore, one might use a different medium of instruction where you expect only a familiarization kind of response wherein the student would describe in general terms what that objective involves, as opposed to a situation in which your objectives said the student must perform this act. In the case of performance, then, of course, you have a higher standard and a need for a more rigid evaluation of it. This in turn might lead you to the type of media which makes sure that that high level of performance will be met. This is much more demanding than an orientation level of understanding and require special media considerations.

Now, from here on I can simply name categories which might simply stimulate your discussion later in the day but which cannot be gone into systematically here. For example, in picking the media instruction, there are various kinds of checklists which different people have published and which you might find access to. In my own AIR monograph #4, "A Handbook of Procedures for Design of Instruction," which I mentioned earlier, there are at least two or three of these. These are checklists, or charts, of information that are intended to remind the designer of education to match the characteristics of his medium with the task characteristics and learner characteristics. One of these, in monograph 4, was done by Bill Freeman (US Army Infantry School). It was his own modification of materials in an Army training manual. These few pages in my handbook list the advantages and shortcomings of different medium modes and methods of instruction and suggests how to overcome the shortcomings when one is forced by circumstance of his physical environment to use a non-preferred method. Well, that kind of checklist could be very useful to a designer.

Another checklist in my handbook was done by a couple of people at the University of Indiana. Here they go into some of the practical

things like how many people can get this message and learn at the same time. How large does the print have to be? Is student feedback required? In other words, there are whole lists of characteristics of media and systems relating to instruction that can help one to select his media alternatives. These include such practical factors as ease of presentation, whether the student can scan forward or scan backwards, or whether, like a lecture, he has to take it and hear it as it goes unless it is recorded. He can't scan backwards and scan forward, often not interrupt.

Another consideration in media selection rests with the questions: Is it important that the learning be self-paced? Can the instruction be successful if it is group paced; or must it be self-paced? Addressing these sorts of questions gets you into other decisions either about different media or about the physical environment in which media are used. For example, the course I mentioned that I have designed at Florida State I had reason for wanting to use instructional television but I also had reasons to want to put the tapes in the library so that the students could get them when they wanted them on their own schedule. If one student needs to see a tape three times before he passed the test over, fine. If he needs to see it once and pass the test, fine. There's no use in holding up the rest of the class, and so on. In that situation I had reasons first for choosing instructional TV but then I had other reasons for deciding to put it on an individual access basis, presenting it on tape in the library rather than to a large audience.

The suggestion has been made that media choices could be automated if you put all these lists of goods--such as I have been discussing--into a computer that you might get the best medium choice out. Up to this point I have taken the position that that isn't possible, largely for this reason but it does stand up to logic that if we have taxonomies, we ought to be able to classify things and make decisions for groups of objectives instead of for individual objectives. I don't view using computers for media selection as feasible because in viewing the learning objective in its most precise form, it's the verb and the object in the statement of the objective that makes it peculiar from all other instances of that type of learning. For example, one concept in physics might be best taught by a film but another concept, also in physics, both in the same type of learning, might be taught best by a live demonstration by the teacher. So, until data prove me wrong, I take the position that a human being with all these considerations in his head can make a better choice of medium than could a computer. I believe I will wait for time to prove that I am wrong.

Now, assuming that the media choices are done with all these things in mind, what decides the success of the instruction conveyed through these media? Well, of course, it's one thing to make a good choice of medium but it's another thing to have expert scripting in that media

so that naturally you could get a biased picture if you tried to teach a lesson two ways experimentally. Say you had an expert motion picture producer to produce an expert motion picture but you hired a "lousy" practitioner of programmed instruction to write your programmed instruction unit, and then you try to compare which media would be best. That, of course, would not be an experiment in a true sense. It is very hard to provide control in media research for the skill of the scripter or the skill of the programmer; it is the skill with which the medium is scripted that makes it very difficult to do well controlled research in this whole field of media, and that explains why many media experiments are not worth the trouble. It does indeed take a good experimental designer to do good research, particularly in the area of methods and media.

Some final comments. Should the media chosen always simulate the real life situation? I realize that's the next topic to be covered so I won't cover it systematically except to say often "yes" and often "no." For example, you recall Edgar Dale's Cone of Experience where you have direct purposeful experience with real life objects and things as the direct form of experience at the bottom of the cone. Up at the top, twelve layers higher, you have verbal symbols, meaning print and logic. Well, if you have a three-year old who cannot read, obviously you expect to teach him most at this direct purposeful experience level; but, if you have a college sophomore, you probably can teach a lot of it by printing and reading. So, again, whether or not the exercises have been simulated, the real world depends upon the objectives and capabilities of the learner.

Finally, your success as an instructional designer will, of course, depend not only on how well your media are chosen, it will depend upon your expertness in scripting in the media and the theory and rationale you are using. As we know, it will also depend on how thoroughly tested and revised it is because no practitioner is good enough to write first draft materials. It needs the testing and revision of empirical trial; and so, in the present state where our theories are weak, our empiricism--try out, test, and revise--has to be strong.

Theoretical Framework in Using
Matrices in Selection of Media and Methods

by

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A discussion of the theoretical framework of methods and media matrices is very like a discussion of the unicorn. In spite of the fact that I can show you a picture of a unicorn, we all know they don't exist.

Our speaker today, Dr. Briggs, has rightly stated in his book that it is not possible to make optimum media selections by simply following a chart, or table, or cookbook which would say essentially "for this competency identify the type of learning listed in a column, finds its intersection with type of learner listed in a row and use the medium named at the intersection" (Briggs, 1970). This statement adequately summarizes the present state of the art of methods and media matrices. There has not yet been developed any specific sequence of steps which will ensure optimal method and media selection. Even to select adequate methods and media is a complex problem solving situation which requires as yet unspecified knowledges and skills. Our business is to provide usable solutions, if not the optimal, as we apply our individual experience, knowledges and skills to the problem of methods and media selection.

Matrices can be a very helpful memory device when we begin to solve the problem of method and media selection. Frequently, a matrix will emphasize to us critical characteristics. It may provide an unfamiliar alternative. Most often a matrix will quickly reduce the universe of possible options to a manageable size, so we can then compare various trade-offs between options. For example, speaking to this last point, one Army matrix puts seven different factors which must be considered on a method selection matrix. They then recommend a method for each factor (although they do not show trade-offs between factors). The most recent media selection matrix by Gerlach and Ely (1971) uses an unweighted matrix layout to ensure consideration of six significant factors--not solving our method and media selection problem but helping us not to forget something important as we put together a solution.

Every systems engineer operates within a given set of constraints in solving method and media selection problems. (SLIDE B 1) There seems to be fairly general agreements among Army people that the

results of task analyses can be grouped into three categories as we create work performance or job objectives. (SLIDE A 1) I am not convinced that we have taken these job objectives seriously enough in our design of training programs. As we look at our job objectives, seriously consider the implications they have for training. Our generally accepted job objectives categories have built-in suggestions as to the possible training problems. Knowledges -- skills -- attitudes. (SLIDE B 2)

Training objectives based on job objectives could then be categorized into simple tasks, mental or motor skills, or social behaviors. (SLIDE C 1) In general, the training emphasis in the respective cases would be upon response selection (doing the right action within the appropriate time frame), response syntheses (gaining proficiency in performing an action), or in exhibiting patterns of response selection (doing the appropriate action in the given context).

At an overall level, the training emphasis implies differential weighing of selected factors in the learning process which are considered in selecting methods and media. Let us visualize the learning process. First, there is a presentation of (SLIDE A 2) information to the learner. The presentation factor includes both introductory and content information--typically, this is what the learner receives in a traditional classroom lecture approach. Next (SLIDE B 3) there is an opportunity to practice or apply the information in some task. In a traditional classroom lecture this may be the instructor's question. The first result (SLIDE B 4) of the application phase is that the learner is able to evaluate for himself both the effort itself and the mental processes involved. This self-evaluation is termed feedback in the model. However, the learner frequently (SLIDE B 5) is provided other evaluation--the instructor--the answer sheet--his peers. This evaluation which the learner receives also provides feedback to the learner in this picture. Note further that the instructor may modify his presentation following his evaluation of the application performance. (SLIDE C 2) The final result is the learner's satisfactory performance of the training objective. Since today's presentation is intended to generate a workshop, here are three questions for discussion.

First The Army has done an excellent job in demanding and getting a reasonably high quality level of presentation when using trained instructors. Numerous directives have emphasized the application requirements and, thus, implicitly the learner feedback requirement has been considered. However, our typical instructional design does not always integrate the two kinds of information requirements. We have either an information presentation-oriented matrix (such as the excellent one developed at Redstone) or a simulator-oriented matrix such as the one by either Miller or Demaree. The first question is: "Why don't we always consider both the presentation and the feedback information requirements in designing a learning program?"

Second The traditional role of the classroom instructor has been (SLIDE A 3) to select appropriate information (SLIDE B 6) to organize this information and (SLIDE C 3) to effectively present the information. But look what systems engineering does (SLIDE A 4). The classroom instructor typically does not select the information, this is done by the systems engineer. He (SLIDE B 7) seldom organizes it, the systems engineer does. In fact, he (SLIDE C 4) may not always present it, instead he may only serve a control function, if the systems engineer determines that another mode of presentation would be superior. It seems that the role of the classroom instructor may require some redefinition. The second question for discussion is: "What should be the functions of a classroom instructor in a modern Army training program?"

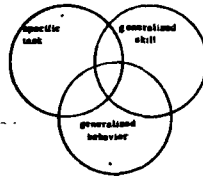
The final question for this workshop is possibly a restatement of the first two.

If, as a systems engineer, I determine Class A will be taught by a classroom instructor and select the lecture method, I will then in Column C, method of instruction, on the Training Analysis Information Sheet, place an L for Lecture (SLIDE B 8). This classroom instructor turns out to do a tremendous job--but he gets orders and I have no replacement. Now make a big assumption. Let us assume that I can put this tremendous instructor on film (SLIDE C 5) or on videotape (SLIDE A 5). Now Column C of the TAIS will read either Film or TV. There should be, however, no difference in learning from any of these three modes by a student attending to this lecture.

In one case we have the classroom instructor, in the other two we have a mediated instructor. Now let us go a step further. With high school and college students it was shown that we can get comparable learning of lecture information by a tape recorder (SLIDE A 6). At college levels the information has been adequately learned without even going to class (SLIDE C 6). Now my final question: "Given a systems engineer who selects, organizes, and determines the way that the information will be provided to the learner, who is the instructor?"

(A handout of the Learning Process Model, Glossary of Terms, Some Media and Methods Matrices and a Bibliography of Media and Methods Matrices was made available to workshop participants.)

JOB OBJECTIVE



81

JOB OBJECTIVES

Specific tasks
(Knowledge, skills, attitudes)
Generalized skills
(knowledge, Skills, attitudes)
Generalized behavior
(knowledge, skills, Attitudes)

A1

TRAINING OBJECTIVES

Simple tasks
Mental skills
Motor Skills
Social behavior

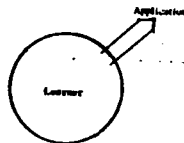
82

TRAINING EMPHASIS

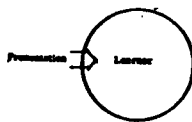
Response selection
Response synthesis
Patterns of response selection

C1

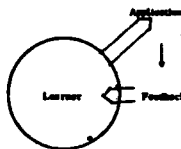
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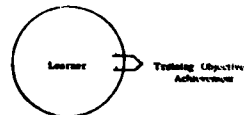
A2



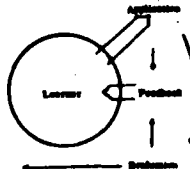
84



C2



85



A3 SELECT

B6 ORGANIZE

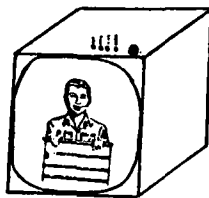
C3 PRESENT

A4 ~~SELECT~~

B7 ~~ORGANIZE~~

C4 ~~PRESENT~~

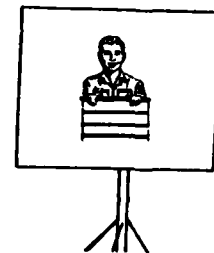
A5



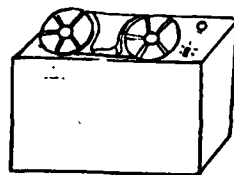
B8



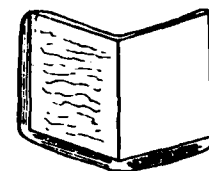
C5



A6



C6



Experience With Methods and Media Selection
At the US Army Missile and Munitions School

by

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As you have noted from the agenda, our area of discussion concerns "Some Theoretical and Practical Consideration in Method and Media." For the next few minutes we will discuss with you our practical experiences at the US Army Missile and Munitions Center and School in this area.

As all of us know, the problem in selecting the most appropriate method, media, and aids for specific training tasks is a difficult one to solve, and we make no claim to having solved it. We at MMCS have made some inroads in providing our staff and faculty personnel with a guide for selecting method, media, and aids so that decisions are no longer based solely on (Slide 1 on) intuitive judgement or personal opinion, but on (Slide 2 on) sound logical analysis or thinking.

We will briefly identify and discuss some of the difficulties we encountered in developing one solution to this selection problem.

Most of you, whether in the military, educational field, or industry, are familiar with the systems engineering approach for developing training programs. This approach, as you know, prescribes a system for identifying the specific tasks and skills involved, the establishment of definitive behavioral objectives and related criteria, and the determination of the optimum or desired instructional environment.

Remember our goal is to provide our staff and faculty personnel with a simple usable tool or guide for selecting the optimum method, media and aids in our training programs.

One of the first hurdles encountered was the requirement to establish common definitions of terminology. We found that a common definition of terms was essential for conveying our ideas to everyone involved in the selection process.

We would now like to discuss a few of the critical or key terms and their definitions. (Slide 3 on)

First, let's look at Method. An instructional method is the primary or principal approach to instruction. It is a systematic plan used for presenting instructional material. It is the orderly procedure for

conducting instruction. Examples: Lecture, demonstration, practical exercise, conference, programmed instruction, tutoring, etc. (Slide 4 on)

Next, let's turn our attention to Medium. An instructional medium is a physical object through which instruction is conveyed or carried. Medium differs distinctly from method in that a medium is a physical object utilized in conveying or delivering instruction to the student, whereas method is concerned with the basic approach or strategy used in presenting subject matter.

Examples: Instructor; Printed Medium (printed materials used to relate lesson content); Projected Medium (device or machine used to transmit, project, or display information); and Teaching Machine (an interaction in which the machine serves as the vehicle or carrier for accomplishing the teaching function).

(Slide 5 on)

And, finally, let's look at Aids. An instructional aid is an object or matter used by a medium to assist in relating information. Its role is to support the medium, generally by providing another channel appealing to the learner's senses. It should never be considered as substituting for or replacing the medium. Examples: Actual equipment; training device (simulator, synthetic trainer); printed or duplicated material (handbooks, schematics, diagrams); graphic (photographs, charts); three dimensional aids or devices (globes, cutaways, mock-ups); projected aids (slides, transparencies, motion picture film, TV tapes); auditory and other sensory stimulators.

Our second problem was to decide which factors our personnel were to consider in selecting method, media, and aids.

(Slide 6 on)

One of these factors is Types of Information. A primary consideration in the selection process is the identification of the type of information to be related. If the objectives of a specific block of instruction requires the development of job knowledges, then the method selected may be different from that involved if the objective were the development of job performance skills.

Objectives must be analyzed to determine the types of information involved with each objective.

(Slide 7 on)

Student Population is another factor. The educational level, prior training, aptitudes, maturity, reading and speaking ability, class size, etc. must be considered when selecting a method. For example, optimum

conditions for the application of specific methods require identification of maximum and minimum class sizes.

(Slide 8 on)

Another factor is Instructors. The number, quality, and competency of available instructors are important factors to consider in selection of a method. For example: If an adequate number of technically qualified and experienced instructors are not available to handle the student input, the use of programed material may be dictated rather than a more appropriate demonstration/practical exercise combination.
(Slide 9 on)

And the last factor is Facilities, Equipment, and Instructional Materials. Each instructional method requires the use of specific types of facilities, equipment, and materials. If the required facilities are not available, an alternate medium may be required. For example: If it has been determined that actual hardware would be the most effective medium for presenting a block of instruction, but the hardware is not available, then an alternate approach will be required.

Having completed the guide we were then faced with the task of preparing our personnel to become adept in employing it.

The guide is used as an annex to our systems engineering regulation. We require that all personnel involved in course development complete our systems engineering workshop. This workshop contains a block of instruction on method, media, and aids selection.

The participants of the workshop are given a detailed explanation of the guide and a practical exercise incorporating the use of this selection matrix.

The matrix is located on the fold-out in the back of the booklet "Criteria for Selecting Methods and Media."

(Slide 10 on)

The matrix contains four columns:

- Column A - Type of Information
- Column B - Methods
- Column C - Media
- Column D - Aids

Remember that the type of information is derived by analyzing the training objectives and they are listed on the vertical axis of the matrix.

The various methods, media, and aids are presented on the horizontal

axis. Each of these is compared to the types of information to be presented and is rated on an effectiveness scale of 1 to 5. A rating of one (1) indicates the most effective method, medium, or aid.

Obviously the matrix must not be used as an infallible solution in the selection process.

As all of you know, the quality of a training program is directly related to the quality of the research and analysis that went into its formation. What we feel that we have accomplished in our effort is to provide our personnel with a simple yet practical and effective tool or guide for assuring a more thorough analysis of each training situation and lesson. As we stated at the beginning of this presentation, we do not claim to have solved the problem but --

(Slide 11 on)

We do believe we have made progress.

At this time, we would like to acknowledge a publication which was very useful in developing the material in our booklet.

The US Army Security Agency Training Center and School's publication, "The Development of Instructional Systems Procedures Manual, 1966."

(NOTE: The US Army Missile and Munitions Center and School Booklet BX 14718, "Criteria for Selecting Methods and Media," was available to conferees as a handout.)

SLIDES FOR, "EXPERIENCE WITH METHODS AND MEDIA SELECTION AT THE
U S ARMY MISSILES AND MUNITIONS SCHOOL

SLIDE 1: MEDIA -- METHODS --STRATEGIES--- AIDS

SLIDE 2: Representation of the, "Thinker"

SLIDE 3: METHOD
 PRINCIPAL APPROACH
 SYSTEMATIC PLAN
 ORDERLY PROCEDURE

SLIDE 4: MEDIUM
 PHYSICAL OBJECT
 A CARRIER

SLIDE 5: AIDS
 OBJECT OR MATTER
 USED TO
 ASSIST OR SUPPORT
 THE MEDIUM

SLIDE 6: TYPES OF INFORMATION..
SLIDE 7: STUDENT POPULATION.....
SLIDE 8: INSTRUCTORS.....FACTORS
SLIDE 9: FACILITIES, EQUIPMENT ..
 AND MATERIALS.....

SLIDE 11: "MEDIA"

SLIDE 10: See page V-42

FACTORS FOR CONSIDERATION COLUMN "A"	METHODS COLUMN "B"									
	CASE STUDY	CONFERENCE	CORRESPONDENCE STUDY	DEMONSTRATION TOUR	LECTURE	PRACTICAL EXERCISE	PROGRAMMED INSTRUCTION	SEMINAR	STUDY ASSIGNMENT	TUTORIAL
TYPES OF INFORMATION										
ASSEMBLY - DISASSEMBLY		4		2	5	1	3			
CONCEPTS, RULES, PRINCIPLES, LAWS, THEORIES		1	4		3		2		5	
DECISION MAKING	3	2					5	1	4	
DIRECTIONS		1	5		2		3		4	
EQUIPMENT OPERATION		3		2	5	1	4			
IDEN AND RECOGNITION		3		2	4	1	5			
LOCATION		3	4	2		1	5			

SLIDE 10

Experience in Methods and Media Selection
at the US Army Southeastern Signal School

by

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Instructional Methods Division
Office of the Director of Instruction
US Army Southeastern Signal School
Fort Gordon, Georgia

I'm satisfied that all of us in the various CONARC schools have experienced difficulty in establishing a systematic and realistic procedure for selecting methods and media as related to the systems engineering process. Here at the USASESS (SLIDE 1) we are using the team approach in system engineering our technical courses. Systems engineering is another expression for using a systematic process in designing a course of instruction (SLIDE 2) starting with job analysis, identifying tasks selected for training, preparation of behavioral training objectives, establishment of an evaluation program and finally preparation of various training literature to include formal programs of instruction, specific lesson plans.

It is during this last phase that a representative from the Instructional Methods Division becomes a member of the systems engineering team. After the course designer identifies the knowledges and skills required to accomplish the training objectives, a specialist from the Instructional Methods Division assists him in selecting methods and media. We have prepared two documents to assist the course designer in selecting methods and media. The first of these documents is (SLIDE 3) A Guide to Planning Instructional Methods and Media Application in Army Training. This research document shows that methods have been subjectively selected while media selections were based on that with which the instructor was familiar or on what was available at the time. A copy of this document will be made available for your retention. (SLIDE 4)

The other document is A Guide to Selecting Methods and Media. This document shows how to select methods and media objectively by analyzing the total learning environment. Worksheets taken from this document will be used during this presentation to illustrate procedures employed at the SESS. This presentation will be centered around the methods and media selection model.

In the initial stage of developing a more definitive methods and media document, four broad requirements for a selection guide were identified. (SLIDE 5) It was of primary importance that it be a working document,

easily used by personnel designing a course. Of course, we wanted the document to identify specific methods and media as well as be compatible with the systems approach. Furthermore, the document had to achieve cost effectiveness. With these four requirements as parameters, the decision was made to develop a methods and media selection model, which would serve as a working guide for course personnel and aid them in fulfilling systems engineering requirements.

When we were tasked with this presentation, we used our methods and media selection model to identify the appropriate methods and media. In fact, we used the same procedure which technical course designers employ in identifying their methods and media. Today, we want to go through that process with you.

You have at your position, three handouts which are taken from the selection document. (SLIDE 6) The first with which you will be concerned is handout #1, "The Methods and Media Worksheet." This worksheet is used to record decisions made during the entire analysis process. The first column is used to list the knowledges and skills required by the training objective. We call these knowledges and skills learning elements. Inherent within each learning element is a type of learning. The type of learning is obtained from the learning chart which is your handout #2.

The types of learning chart identify twelve types of learning which are applicable to the training conducted in the Southeastern Signal School. The terminology and definitions are compatible with training here; they may be meaningful in your training environment as we have identified them, or you might need to modify them. Your third handout, the Methods and Media Selection Model, is a matrix which combines the type of learning with the instructional strategy to arrive at appropriate methods and media.

Using these handouts we will follow a five-step process (SLIDE 7) to select the appropriate methods and media for one of six learning elements in this presentation. As a result of this exercise, you will have a working knowledge in the use of the methods and media selection model. I will go through the process in a step-by-step manner with each of you working on handouts at your position. As we progress through the process, you will make appropriate responses on your worksheet. If you have a question concerning any particular process, circle that portion so that you will remember to ask the question during the discussion period. In the initial stages of this presentation, you will only be using the worksheet and the types of learning chart.

Let's take a look at handout #1 (SLIDE 8), Methods and Media Worksheet. The first column is entitled "Learning Elements." Remember that learning elements are simply those skills and knowledges required to accomplish the training objective.

(SLIDE 9) Our objective and the six learning elements of this presentation are shown on this slide. We will only develop one of these learning elements on your worksheet. (SLIDE 10) The learning element which we have selected is "Use Methods and Media Selection Model." Write this in the first column under "Learning Element" on the Methods and Media Worksheet. Those of you who are familiar with the systems engineering process will obtain learning elements from training analysis information sheets. Those of you who do not obtain learning elements from training analysis information sheets will obtain them from lesson outlines or syllabi.

We have classified learning elements into (SLIDE 11) twelve types of learning. Take a few moments to look at the types of learning on hand-out #2. Using this chart, the course designer must now determine the type of learning involved in each learning element. You are learning to use (SLIDE 12) the "Methods and Media Selection Model" which requires manual involvement. Therefore, we have classified this learning element as "Manipulation." (SLIDE 13) Enter manipulation in this "Type of Learning" column of the Methods and Media Worksheet, as is shown in this example.

Once the type of learning has been determined, the designer can use the learning chart to identify the columns of the selection model from which he will select methods and media. (SLIDE 14) This information is found in the right hand columns. The learning chart indicates that Methods Column V and Media Column F would be used for manipulation. The number of the Methods Column and the letter of the Media Column (SLIDE 15) are entered for each learning element on the worksheet. Write Roman numeral V in the Methods Column and "F" in the Media Column of your worksheet. We will not be referring to the "Types of Learning Chart" again so you might just turn it over. We will only be working with handout #1 for the next few minutes.

So far, we have listed the learning element, the type of learning and identified the methods and media columns. Now we are ready for the third step in the selection process--that of determining the instructional strategy. By answering five discriminatory questions in a "yes" or "no" fashion we will determine the appropriate instructional strategy. In anticipation of computerizing the process (SLIDE 16) a binary numbering system is employed. The numeral "1" is equivalent to a "yes" answer and the number "0" is equivalent to a "no" answer. (SLIDE 17)

These five questions enable the designer to study the total learning situation in order to arrive at an instructional strategy.

INSTRUCTIONAL STRATEGY

1. Will instruction be self-paced?
2. Does the student have a background?

3. Will an instructor be the primary medium?
4. Is a response required?
5. Does the student read satisfactorily?

In the initial phase of identifying an instructional strategy, the designer must decide whether instruction is to be group or self-paced. The first discriminatory question which the designer must answer is (SLIDE 18) "Will the instruction be self-paced?" To determine if self-paced instruction is to be used, the course designer should ask himself the following questions: (SLIDE 19)

1. Does learning include value judgments?
2. Does subject material or equipment change frequently?
3. Must the student learn within a structured time frame?
4. Will a self-paced program cost more?
5. Does the task require a team effort?

If the answer to any of these questions is "yes", then the instruction lends itself more to group instruction than to self-pacing. Once determined, the designer uses the appropriate binary symbol to answer the question on the Methods and Media Worksheet. "Will instruction be self-paced?" If instruction is to be self-paced, the designer would place a "1" in the block. This presentation, however, is not self-paced because we are restricted to a twenty-minute time frame, so we place a "0" there. (SLIDE 20) Would you put a "0" on your worksheet under "Self-paced?"

An analysis of the learning situation enables the course designer to assess the repertory of the student. The second discriminatory question which must be answered is (SLIDE 21) "Does the student have a background?" In order to answer this question, it must be determined if the learner has had previous training or experience which may transfer to the current learning element. This decision is then noted on the worksheet. (SLIDE 22) You have had training and experience in preparing instructional programs; consequently, we have said "yes" the student has a background. Place a "1" under "S" has background.

The third discrimination is actually a media determination. (SLIDE 23) A trained, dedicated, sensitive instructor is the best media available to a classroom. He is capable of presenting, evaluating, and remediating. Only with costly planning and programming can a computer approach this capability. Yet, even an instructor cannot present, evaluate, and remediate simultaneously. The designer must determine the role of that instructor in the classroom. (SLIDE 24) If the instructor is to be the primary conveyance of information, a "yes" answer is recorded on the worksheet. A "no" decision indicates that the primary learning stimulus will be presented by a medium other than the instructor. It does not, however, mean that an instructor will fail to be in the classroom. A "no" means that the instructor has a supportative role. The

designer will record a "no" decision when any of the following is true: (SLIDE 25)

1. Instructors have difficulty teaching the learning element.
2. A high degree of standardized instruction is required.
3. When the number of available instructors is limited.

When the course designer has decided to self-pace a course, he must recognize that it is the inherent nature of self-pacing to require a primary medium which is other than the instructor. The designer will only defeat his initial decision if he identifies the instructor as a primary medium rather than as a supportative one. The answer to this question is then entered on the worksheet. For this presentation I've classified myself as the instructor and you as students. (SLIDE 26) So, place a "1" under "Instructor" on the worksheet. I am considered to be the primary medium during this presentation.

The fourth discriminatory question asked in the Instructional Strategy Process is (SLIDE 27) "Will instruction be response oriented?" Two basic approaches to instruction exist: Stimulus oriented and response oriented. (SLIDE 28) Instruction is stimulus oriented when over-riding emphasis is placed on presenting the learning element while requiring little or no student response.

(SLIDE 29) On the other hand, a response oriented presentation strives to require continual learner response. If the learner must respond to the learning element, the designer would record a "yes" answer in the appropriate column. Remember that we said this was a manipulation. In order to achieve the objective, you had to respond. (SLIDE 30) Place a "1" in that column.

The final discriminatory question assesses the student's reading capabilities (SLIDE 31) for the purposes of determining the instructional strategy; a satisfactory reading level is defined as the ability of a student to read and understand faster than he can hear and understand the subject being taught. In making this decision, the designer must remember that during the early stages of a program of instruction, the learner will probably not be able to read and understand the subject matter as fast as he can hear and understand the same information. Again, the course designer enters the appropriate answer to this question on the Methods and Media Worksheet. The reading level of this group is satisfactory. (SLIDE 32) So, place a "1" under "S" Reads.

Once the designer has progressed to this point in determining the instructional strategy, he is ready to use the Methods and Media Selection Model which is handout #3. At the top of the model you will notice that there is a listing of methods and media with abbreviations. The left portion of the matrix identifies methods while the

right portion identifies media. The column on the extreme left identifies the instructional strategy you have designed. Having answered the five discriminatory questions (SLIDE 33), we have created a binary number which represents an instructional strategy. This can be located in the Instructional Strategy column found on the Methods and Media Selection Model. Your Methods and Media Model has been marked for ease in locating the binary number. (SLIDE 35) If you move horizontally across the model to the point where this number intersects the Methods Class V, you will find an abbreviation for the specific method appropriate for this learning element. The method indicated here, which we have used, is Controlled Practical Exercise. Now the method is written in the "Learning Element Method" column of the worksheet. (SLIDE 36) Write CPE in this column.

To determine the "Learning Element Media" (SLIDE 37) continue to move across the Methods and Media Selection Model, using the same binary numbers to Media Class "F". The media indicated is I for Instructor, with AO--Actual Object, and P for Print. (SLIDE 38) Enter I, W, AO, and P in "Learning Element Media" column on the worksheet.

The final step in the methods and media selection process is to identify overall "Lesson Methods and Media." So far we have traced through only one learning element in this presentation. If we had time, we would have had to develop six learning elements in order to determine the overall lesson methods and media. (SLIDE 39) This slide shows all six learning elements and the overall lesson methods and media.

You probably are wondering why the "L" is not classified as a lesson method. The lecture is actually part of the controlled PE. In other words, the lecture is the stimulus portion of the Controlled Practical Exercise. Therefore, it is not necessary to list lecture as a separate lesson method. Write CPE in the Lesson Method column. The media for this presentation were identified as Instructor with still visuals, actual object, and print. The model is the Actual Object. Enter I W/SV, AO, and P in the Lesson Media column.

We've used this presentation itself to demonstrate the selection process. There are, however, some requirements. (SLIDE 40) Because of the analysis required, course designers will need an orientation to the selection process. The course designer can build into his decision some degree of prejudice. Management and staff agencies must assume responsibility for insuring that overall course design reflects the CONARC philosophies of hands-on-training, recognizing individual differences as indicated by the use of multi-methods and multimedia. Since cost effectiveness is a requirement, a file of available school media resources and their capabilities must

be established in a central location as a reference point for the course designer and his manager.

The selection model will prove to be a useful tool for the course designer since to use it, he must scrutinize the total learning environment. (SLIDE 41) It will provide the basis for standardizing methods and media selections. Objective rather than subjective decisions can be made. Effectiveness and reduced cost is obtained because the learner, the objective, and the learning situation must be analyzed. Finally, it provides a foundation for continued course improvement.

Courses are constantly attempting to improve. This selection process provides a basis from which to optimize. After the program is implemented, the designer in conjunction with the classroom instructor can easily identify problem areas. Some students may not have capabilities ascribed to them originally. Alternate methods and media may be required for certain students thus necessitating the design of additional individualized packages.

In summary, we have attempted to construct our Methods and Media Selection Model on the framework provided by systems engineering. We tried to take into account the repertory of the student, the type of learning involved, and the requirements necessary to facilitate that learning while employing in the initial stages the resources currently available within the school. This selection model recognizes and emphasizes that students are different and that they learn differently. A natural by-product of that recognition is -- commitment to the continued development of a multimethod/multimedia approach to learning.

(NOTE: US Army Southeastern Signal School Pamphlet No. 350-1, "A Guide to Planning Instructional Methods and Media Application in Army Training," August, 1971, was available as a handout to the participants.)

SLIDES FOR, "EXPERIENCE IN METHODS AND MEDIA SELECTION AT THE
SOUTHEASTERN SIGNAL SCHOOL"

- SLIDE 1 U.S. ARMY SOUTHEASTERN SIGNAL SCHOOL
- SLIDE 2 SYSTEMS ENGINEERING
JOB ANALYSIS
IDENTIFYING TASKS FOR TRAINING
PREPARATION OF BEHAVIORAL TRAINING OBJECTIVES
EVALUATION PROGRAM
PREPARATION OF TRAINING LITERATURE
- SLIDE 3 USASESS PAM 350-1: GUIDE TO PLANNING INSTRUCTIONAL METHODS
AND MEDIA APPLICATION IN ARMY TRAINING
- SLIDE 4 USASESS PAM 350-2: A GUIDE TO SELECTING METHODS AND MEDIA
- SLIDE 5 SCOPE
WORKING DOCUMENT
IDENTIFYING SPECIFIC METHODS AND MEDIA
COMPATIBLE WITH SYSTEMS ENGINEERING
COST/EFFECTIVE
- SLIDE 6 HANDOUTS
1. METHODS AND MEDIA WORKSHEET
2. TYPES OF LEARNING CHART
3. METHODS AND MEDIA SELECTION MODEL
- SLIDE 7 METHODS AND MEDIA SELECTION PROCESS
1. IDENTIFYING LEARNING ELEMENTS
2. DETERMINE TYPES OF LEARNING
3. DETERMINE INSTRUCTIONAL STRATEGY
4. DETERMINE LEARNING ELEMENTS METHODS AND MEDIA
5. DETERMINE LESSON METHODS AND MEDIA
- SLIDE 9 OBJECTIVE: CONFEREES WILL USE THE METHODS AND MEDIA
SELECTION MODEL
- | | <u>KNOWLEDGES</u> | <u>SKILLS</u> |
|--|-------------------|---------------------------------------|
| | PARAMETERS | USE METHODS AND MEDIA WORKSHEET |
| | SELECTION PROCESS | USE METHODS AND MEDIA SELECTION MODEL |
| | HANDOUTS | IDENTIFY LESSON METHODS AND MEDIA |
- SLIDE 8 See V-58
- SLIDE 10 See V-60
- SLIDE 11 See V-61
- SLIDE 12 See V-62
- SLIDE 13 See V-63
- SLIDE 14 See V-64
- SLIDE 15 See V-65

Replaces Pages V-52, 53, 54, 55
56, 57 & 59

METHODS AND MEDIA WORKSHEET

		LEARNING ELEMENTS										TYPES OF LEARNING									
INSTRUCTIONAL STRATEGY	LEARNING ELEMENTS																				
	METHODS CLASS																				
	MEDIA CLASS																				
	SELF-PACED?																				
	"S" HAS BACKGROUND																				
	INSTRUCTOR?																				
	RESPONSE ORIENTED?																				
	"S" READS?																				
	LEARNING ELEMENT METHOD																				
	LEARNING ELEMENT MEDIA																				
LESSON METHODS																					
LESSON MEDIA																					

[illegible]

TYPES OF LEARNING CHART

TYPE OF LEARNING	METHODS		MEDIA
	COLUMN	COLUMN	COLUMN
1. DECISION - Selecting a course of action	IV		A
2. EVALUATION - Making value judgments	VI		F
3. DIAGNOSIS - Using cues to identify solutions	I		B
4. INSPECTIONS - Checking against standards	III		E
5. MANIPULATION - Manual involvement	V		F
6. PROCEDURE - How to proceed	I		B
7. PRINCIPLE or THEORY - Why, how, or when	I		B
8. OPERATION - How something functions	II		D
9. ORGANIZATION - Chain of parts	I		B
10. CONSTRUCTION - Make up of things	I		C
11. IDENTIFICATION - Name and location	I		C
12. FACT - A rule, definition, or equation	I		A

TYPES OF LEARNING

CHART

TYPE OF LEARNING	METHODS CLASS	MEDIA CLASS
<u>SKILLS</u>		
1. <u>DECISION</u> - Selecting a course of action	IV	A
2. <u>EVALUATION</u> - Making value judgements	VI	F
3. <u>DIAGNOSIS</u> - Using cues to identify solutions	I	B
4. <u>INSPECTIONS</u> - Checking against standards	III	E
5. <u>MANIPULATION</u> - Manual involvement	V	F
<u>KNOWLEDGES</u>		
6. <u>PROCEDURE</u> - How to proceed	I	B
7. <u>PRINCIPLE or THEORY</u> - Why, how, or when	I	B
8. <u>OPERATION</u> - How something functions	II	D
9. <u>ORGANIZATION</u> - Chain of parts	I	B
10. <u>CONSTRUCTION</u> - Make up of things	I	C
11. <u>IDENTIFICATION</u> - Name and location	I	C
12. <u>FACT</u> - A rule, definition, or equation	I	A

[illegible]

V-63

Bandout #1

TYPES OF LEARNING

CHART

<u>TYPE OF LEARNING</u>	<u>METHODS CLASS</u>	<u>MEDIA CLASS</u>
<u>SKILLS</u>		
1. <u>DECISION</u> - Selecting a course of action	IV	A
2. <u>EVALUATION</u> - Making value judgements	VI	F
3. <u>DIAGNOSIS</u> - Using cues to identify solutions	I	B
4. <u>INSPECTIONS</u> - Checking against standards	III	E
5. <u>MANIPULATION</u> - Manual involvement	V	F
<u>KNOWLEDGES</u>		
6. <u>PROCEDURE</u> - How to proceed	I	B
7. <u>PRINCIPLE or THEORY</u> - Why, how, or when	I	B
8. <u>OPERATION</u> - How something functions	II	D
9. <u>ORGANIZATION</u> - Chain of parts	I	B
10. <u>CONSTRUCTION</u> - Make up of things	I	C
11. <u>IDENTIFICATION</u> - Name and location	I	C
12. <u>FACT</u> - A rule, definition, or equation	I	A

[illegible]

- SLIDE 16 BINARY NUMBERING SYSTEM
1 - YES 2 - NO
- SLIDE 17 INSTRUCTIONAL STRATEGY
- 1 1. Self-paced
 2. Background
 3. Instructor
 4. Response
 5. Reads
- SLIDE 18 Will Instruction Be self-paced?
- SLIDE 19 1.DOES LEARNING INCLUDE VALUE JUDGEMENTS
 2.DOES SUBJECT MATERIAL OR EQUIPMENT CHANGE FREQUENTLY
 3.MUST THE STUDENT LEARN WITHIN A STRUCTURED TIME FRAME
 4.WILL A SELF-PACED PROGRAM COST MORE
 5.DOES THE TASK REQUIRE A TEAM EFFORT
- SLIDE 20 See V-70
- SLIDE 21 DOES THE STUDENT HAVE A BACKGROUND?
- SLIDE 22 See V-72
- SLIDE 23 IS THE INSTRUCTOR THE PRIMARY MEDIUM ?
- SLIDE 24 INSTRUCTOR PRIMARY MEDIUM?
 YES-1
 INSTRUCTOR SUPPORTIVE MEDIUM
 NO==0
- SLIDE 25 1. INSTRUCTORS HAVE DIFFUICULTY TEACHING THE LEARNING ELEMENT
 2. A HIGH DEGREE OF STANDARDIZED INSTRUCTION IS REQUIRED
 3. WHEN THE NUMBER OF AVAILABLE INSTRUCTORS IS LIMITED
- SLIDE 26 See V-76
- SLIDE 27 WILL INSTRUCTION BE RESPONSE ORIENTED?
- SLIDE 28 STIMULUS & RESPONSE METHODS
 STIMULUS
 ORIENTED = NO
 Lecture
 Demonstration
 Study Assignment

[illegible]

[illegible]

V-72

Handout #1

[illegible]

SLIDE 29

STIMULUS AND RESPONSE METHODS

STIMULUS	RESPONSE
ORIENTED = NO	ORIENTED = YES
Lecture	Conference
Demonstration	Practical Exercise
Study Assignment	Case Study
	Incident Process
	In-Basket Process
	Programed Instruction
	Tutorial
	Role Playing

Slide 30 See V-80

SLIDE 31 DOES THE STUDENT READ SATISFACTORILY?

SLIDE 32 See V-82
SLIDE 33 See V-83
SLIDE 34 See V-84
SLIDE 35 See V-85
SLIDE 36 See V-86
SLIDE 37 See V-87
SLIDE 38 See V-88
SLIDE 39 See V-89

SLIDE 40

REQUIREMENTS

1. Orientation For Course Designers
2. Establishment of School Media Resource File

Slide 41

BENEFITS

1. Standardization
2. Objective Rather Than Subjective Decisions
3. Reduces Costs
4. Provides A Foundation For Continued Course Improvement

[illegible]

[illegible]

[illegible]

V-83

METHODS AND MEDIA SELECTION MODEL														
INSTRUCTIONAL STRATEGY			COACH AND PUPIL			METHODS			MEDIA					
I- YES	O- NO	Background?	Instructor?	Response?	Self-paced?	C&P			IPE					
						C&P	COACH	PUPIL	C&P	COACH	PUPIL			
0	0	0	0	0	0	L	D	D	VI	A	A	D	E	F
0	0	0	0	0	0	SA	D	D	D	A	A	A w/AO&SV	A w/AO&SV	A w/MV
0	0	0	0	0	0	CPE	CPE	CPE	CPE	P	P w/AO&SV	P w/SV	P w/MV	P w/MV
0	0	0	0	0	0	(PI)	(PI)	(PI)	(PI)	A	A w/AO&SV	A w/SV	A w/MV	A w/AO&SV
0	0	0	0	0	0	L	D	D	D	P	P w/AO&SV	P w/SV	P w/MV	P w/AO&SV
0	0	0	0	0	0	L	D	D	D	I	I w/AO	I w/SV	I w/AO	I w/AO
0	0	0	0	0	0	L	D	D	D	I w/P	I w/AO&P	I w/SV&P	I w/AO&P	I w/AO&P
0	0	0	0	0	0	IC	C&D	CPE	IC	I	I w/AO	I w/SV	I w/AO	I w/AO
0	0	0	0	0	0	IC	C&D	CPE	CPE	I w/P	I w/AO&P	I w/SV&P	I w/AO&P	I w/AO&P
0	0	0	0	0	0	L	L	L	L	A	A w/SV	A w/SV	A w/SV	A w/SV
0	0	0	0	0	0	SA	SA	SA	SA	P	P w/SV	P w/SV	P w/SV	P w/SV
0	0	0	0	0	0	PE	PE	C&P	CS	A	A w/SV	A w/SV	A w/AO	A w/SV
0	0	0	0	0	0	(PI)	(PI)	PE, TP	CS	P	P w/SV	P w/SV	P w/AO	P w/SV
0	0	0	0	0	0	L	L	L	L	I	I w/SV	I w/SV	I w/SV	I w/AO
0	0	0	0	0	0	L	L	L	L	I w/P	I w/SV&P	I w/P	I w/SV&P	I w/AO&P
0	0	0	0	0	0	DC	DC	CPE	DC	I	I w/SV	I w/SV	I w/AO	I w/AO
0	0	0	0	0	0	DC	DC	CPE	RP	I w/P	I w/SV&P	I w/P	I w/AO&P	I w/AO&P
0	0	0	0	0	0	L	D	D	D	A	A w/AO&SV	A w/SV	A w/AO&SV	A w/MV
0	0	0	0	0	0	SA	D	SA	D	P	P w/AO&SV	P w/SV	P w/AO&SV	P w/MV
0	0	0	0	0	0	IPE	IPE	IPE	PI	A	A w/AO&SV	A w/SV	A w/AO&SV	A w/AO&SV
0	0	0	0	0	0	(PI)	(PI)	(PI)	PI (IE)	P	P w/AO&SV	P w/SV	P w/AO&SV	P w/AO&SV
0	0	0	0	0	0	L	D	D	D	I	I w/AO	I w/SV	I w/AO	I w/AO
0	0	0	0	0	0	L	D	D	D	I w/P	I w/AO&P	I w/SV&P	I w/AO&P	I w/AO&P
0	0	0	0	0	0	L	D	D	D	I w/AO	I w/AO	I w/AO	I w/AO	I w/AO
0	0	0	0	0	0	T	T	T	T	I w/P	I w/AO&P	I w/SV&P	I w/AO&P	I w/AO&P
0	0	0	0	0	0	T	T	T	IP	I w/P	I w/AO&P	I w/SV&P	I w/AO&P	I w/AO&P
0	0	0	0	0	0	L	L	L	L	A	A w/SV	A w/SV	A w/SV	A w/SV
0	0	0	0	0	0	SA	SA	SA	SA	P	P w/SV	P w/SV	P w/SV	P w/SV
0	0	0	0	0	0	IPE	IPE	IPE	PI	A	A w/SV	A w/SV	A w/AO	A w/AO
0	0	0	0	0	0	(PI)	(PI)	IPE	PI	P	P w/SV	P w/SV	P w/AO	P w/AO
0	0	0	0	0	0	L	L	L	L	I	I w/SV	I w/SV	I w/SV	I w/SV
0	0	0	0	0	0	L	L	L	L	I w/P	I w/SV&P	I w/P	I w/SV&P	I w/SV&P
0	0	0	0	0	0	T	T	T	T	I	I w/SV	I w/AO	I w/AO	I w/AO
0	0	0	0	0	0	T	T	T	T	I w/P	I w/SV&P	I w/P	I w/AO&P	I w/AO&P

SLIDE 34

V-84

METHODS AND MEDIA SELECTION MODEL

[illegible]

[illegible]

FERROIDS AND MEDIA SELECTION MODEL

[illegible]

[illegible]

[illegible]

Discussion Resulting from the Presentations in Workshop Session #1,
"Some Theoretical and Practical Considerations in Methods and Media"

Discussion Leader: Mr. Richard S. Kneisel, Education Advisor,
United States Army Infantry School

Mr. Kneisel: We would like to entertain any questions at this point. You might want to use some of the questions on the sheet just to start off with any of the discussion. Do you have any points that anyone wants to raise at this juncture? Are you so saturated with knowledge at this point that you just sit back waiting for it to soak in? Mr. Jones?

Jay Jones: I'm Jay Jones from the WAC School, Fort McClellan. I would like to ask Mrs. Lakeman what method do you use to determine whether the students can read at the level that the programmed texts are supposedly written?

Mrs. Lakeman (Southeastern Signal School): Well, our definition of reading is whether the student can read and understand the material faster than he can hear, not whether he can read. If he can't read the material and understand it, then you can use an audio medium.

Mr. Jones: What device do you use to determine the reading ability?

Mrs. Lakeman: I guess you can give him a test

Mr. Jones: Oh, you don't use a test or device? That's my question-- I was just asking what device do you use?

Mr. Kneisel: Mrs. Lakeman, you don't have a formalized testing system to get at the reading level of the individual at this point?

Mrs. Lakeman: No, you should just check on him.

Mr. Kneisel: Are there any other questions?

Mr. Flint: Carl Flint of the National Medical Audiovisual Center, I have a question for Dr. Briggs. It is somewhat loaded, Dr. Briggs, so forgive me. Previously, I'd been with the Audio Pictorial Service for twenty some odd years, and now with HEW. up to my ears in medical education. The problem that we find is in relation to the technologist and the educationists. It's when you get into the implementation of media where aesthetics, I believe, comes into play. How do you get a happy mix of the education to go with the media specialists so as to meld their aesthetic presentation with proper learning techniques? You get the self-styled education specialist who becomes the media specialist and vice versa the media specialist who tries to become the educator; this appears to be wrong. How do you equate

and solve that problem?

Dr. Briggs: This is, of course, a familiar question. That's the question you asked relevant to another meeting. The same thing comes up in programmed instruction. How do you get the technologist who presumably is a programmer to work with the subject matter expert? You have asked a little different question but these are similar things. Naturally, the happiest solution is perhaps an experience like I had this summer; but, of course, it's based on personalities instead of principles. But I had the pleasure this summer in working out the video tape for my own course after I had the approach and script outline in mind. We have Dr. Tom D. Capuzzi who was the director of our Instructional TV Training and Facilities at Florida State. I guess the ideal answer is to have a friendly relationship between the two people because, fortunately, he knew that presumably I am a specialist and I know he is a specialist. We simply decided which one of us should make which decision. And we just hadn't a problem because he knew that my principal argumentation is that when it's all done--when the students see this tape in the library, they can pass the test themselves and he knew that I really don't care whether the pictures are artistically pretty or what, just so long as they do their best. I know, in return, that since he is an ITV man, he is a combination man. I think he rates artistry high and he places high quality on electronic equipment that will produce the kinds of shadows on the screen that he wants. So I guess the ideal answer is to be good friends. He and I were, and we never had a problem. I guess, if you are not good friends, then you resort to some sort of agreement where, I suppose, you get together and say: "Now, here's presumably my job and here's yours; how can we work together to make decisions so that I, on my part, am satisfied with the behavioral results of the film in terms of the student's learning and demonstration of learning, and how can I help you to be satisfied--that you are artistically pleased with the results of it." In this one happy experience with my courses at Florida State University, we didn't have a disagreement. The only thing I can say is that where there isn't a friendly agreement, I guess the only other thing is try to sit down and create together a modus operandi where you say let's put down on paper, if we can, a plan in which we can jointly cooperate together in the final product. I don't know how else to answer it except to say every day similar experiences--as I have said, in general programmed instruction where I was trying to work with the subject matter expert--is to try to let him decide whether the course information was there and ask him to let me decide the size step of the other characteristics of the thing. But I guess it really boils down to having a mutual respect for each other's strong points. I wouldn't have bothered quarreling with Tom about which hammer he uses to achieve this effect in this part of the script, nor did he quarrel with me as knowing what I wanted the script to do, as shown by the students at the end of the test. So I guess mutual respect is the best way to get it done.

Mr. Kneisel: Thank you. That's just fine. I think I'm going to have to break off this part of the discussion, and we hope you've got some other questions and come back tomorrow to get some of these things answered. So, if you want to break now and get together, you can. Thank you very much.

Dr. Robert Lehrer (Georgia Tech): The terms of using the design procedural involved in this procedure--let's assume that it's going to be a one-time presentation. What is the time and cost in implementing that design procedure for a one-time presentation?

Mr. Kneisel: Did you hear the question? If this is a one-time procedure, what's the cost for doing that? This is in relation to the Southeastern Signal School's presentation. Mrs. Lakeman, would you care to answer that, please?

Mrs. Lakeman: I am not sure that I understand the question. Is this a one-time pitch?

Dr. Lehrer: Let's assume we are preparing it for a course; for example, preparing for this presentation here today. What is the cost in time and other costs in the preparation up to this point of the preparation?

Mrs. Lakeman: Well, I really don't know how to answer that. Do you mean how much time did we spend on our presentation?

Dr. Lehrer: Yes, that would do.

Mrs. Lakeman: I don't know how you could measure that in relation to other presentations. We spent a great deal of time on it. We planned to use it in our training of staff and faculty so it is not a one-time presentation.

Mr. Kneisel: If I may, let me inject myself in this. I think that one of the things we have to approach here is that we're talking in the Army school configuration where these periods of instruction are presented over and over, at least within a given academic year--in fact, maybe a month or two--because some classes are repetitive and they are coming through quite rapidly. If we are talking about, as in your case, a single college course (a single one-hour presentation that is not given any more), the amount of effort that must be expended in using the matrix might be considerable and that means that somebody else would have to evaluate how much effort can be expended. Am I addressing your point properly?

Dr. Lehrer: You are. Thank you.

Mr. Kneisel: Dr. Crawford?

Dr. Meredith Crawford (President, HumRRO): The question is:
How was the matrix developed?

Mrs. Lakeman: We started out with knowledges and skills. All the way through we found that it just didn't break out well enough. It did break out far enough to identify the methods but the not the media that was required for each task. We then had to go back and identify the types of learning that were within our school. Thereupon, we went to each type of learning and we made a decision about each. We made all of the decisions that you see on the matrix about each type of learning. When we finished that, we saw that some types of learning required the same methods as another type of learning and that maybe one type of learning required the same media as another type. So, that's how we got those procedures. It's a very long process and it involved media.

Dr. Lehrer: Let me pressure you a little bit. For example, how do you decide that you made a lot of decisions with one medium which was indeed promotable?

Mrs. Lakeman: How do we decide one medium? Will you give me an example? Like print?

Dr. Lehrer: Yes.

Mrs. Lakeman: Print for somebody who can read. You'll see that print is a medium which requires no response, no instructor, no background, but only skill in reading. If he could not read, you would use an audio. If he could read and he had no instruction but you wanted a response, you might have a PI text. But the text is print and print is a medium and PI is a text. Does that answer your question?

Dr. Lehrer: Yes.

LTC Alvin Meredith (Office, Chief, Research and Development, DA): I want to ask Dr. Briggs if, in his course developed at Florida State, did you consider the computer as a medium in any of its forms?

Dr. Briggs: Yes, we do. My reply is very simply based on my own terminology. It's not a matter of issue. It's a matter of command. Yes, I would classify it in agreement with some of the other classifications. The medium is the final physical delivery system. Just to amplify it a little bit--some media, as Marshall McLuhan has pointed out--are media within media. For example, no matter how you went about making the decisions, once you have chosen instructional television as the medium you still have a lot of option on whether it's going to be a lecture or a demonstration or a series of visuals or is a motion picture projector. So, although there are sorts of media within media questions and Marshall McLuhan practically pointed out

that the only pure medium is light, that anything other than pure light are media within media; for example, the typical lecture/discussion employs really several media if you include print--print as projected on a blackboard, by a projector, by the teacher writing, and so on. It's just a matter of terminology and many media specialists do not have a standard terminology. The presentations today show that mine is the same kind of terminology. Just as a matter of terminology, I wouldn't classify CAI as a medium even though I realize that the type of stimulation in one frame may be print, the next frame may be pictorial.

Mr. Kneisel: Dr. Smith, do you have a question?

Dr. Edgar Smith (Lowry AFB): I wonder if Mrs. Lakeman could define what does she mean by methods 1, 2, 3, 4, and 5?

Mr. Kneisel: Mrs. Lakeman, can you define what you mean by methods 1, 2, 3, 4, and 5 in your matrix?

Mrs. Lakeman: Method and expedience. The response relationship which exists between the learner and the media. The media is the means by which a student fits in.

Dr. Smith: What do you mean by method 1, 2, 3, 4, and 5?

Mrs. Lakeman: That's a call. Simply a reference call.

Dr. Smith: What do you mean by method 1? What is method 1?

Mrs. Lakeman: This is the way we grouped types of learning to identify the methods and then we saw that some types of learning required the same type of method. To make it into a concise form we said this is call 1. And we did the same with the media. In a sense it was an administrative grouping.

Mr. Kneisel: That was a value judgment on your part as the designer of this matrix, right?

Mrs. Lakeman: Those are the methods which fit the design--instructional design--which are found on that matrix. The media are documented or arrived at through some study; for instance, tests.

Mr. Kneisel: Lieutenant Guptil who worked with Mrs. Lakeman on this matrix may be able to help.

LT Bob Guptil (Southeastern Signal School): As far as the media determinations are concerned, they are not fully and specifically substantiated by research material. Much of the backup material will be found in another document which we do not have as yet but will

substantiate the whole taxonomy. This document when finalized will be the basis of the whole thing.

Mr. Kneisel: Fine. Thank you, Lieutenant Guptil. Mr. Dare, do you have a question?

Mr. Frank Dare (Ordnance School): It's not very clear--in looking at this Southeastern Signal School matrix--why must we interpret with a yes/no in the column where it says "self-paced," that we say self-paced or not self-paced, meaning self-paced or lock step? We have some courses at the Ordnance School (and I presume others do, too) where individual self-pacing is not possible because we are teaching group crew performance. We have looked toward the possibility of individual self-pacing versus group self-pacing versus lock step. How would that interpretation of group pacing appear on this matrix?

Mrs. Lakeman: I think that what you are talking about is self-pacing within a fixed time frame?

Mr. Dare: Not necessarily. Where a group proceeds at its own pace--a crew performing a job.

Mrs. Lakeman: A practice does come out in the matrix.

Mr. Dare: I see. That's team practice in your matrix. But, in making your decision self-paced, you would not really be individually self-paced. How would you mark it if you are designing for a team?

Mrs. Lakeman: Team practice is not self-paced. You may have a team which is ahead of another group but the group within that group is not individually paced. Because of the abilities within that group, they may be ahead of another group.

Mr. John Danilovich: (Southeastern Signal School) It's kind of complicated. I helped worked on the matrix so perhaps I can give some light. You have group paced and self-paced. A group can move at its own rate but certainly the individuals within the group cannot move at their own rate. They have to wait on their group. So, it's still group paced within the parameters of time. Nobody's contending the lock step. Certainly in this thing you can see there are many different types of techniques or methods that don't apply lock step.

Mr. Kneisel: Mr. Dare, perhaps you and the Southeastern Signal School personnel would like to carry on this discussion during the break.

WORKSHOP SESSION NO. 2

MINIATURIZATION, SIMULATION, AND SIMULATORS

Perspectives on Simulation and Miniaturization

by

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Slide 1 (Title)

Introduction

The purpose of this presentation is to suggest a conceptual framework for making decisions regarding the use of simulation. We will consider such things as the applications of simulation, the factors involved in selecting a simulation methodology, the aspects of the system to be simulated, and the conditions necessary for transfer to the real world. Finally, we will examine some training applications of simulation and miniaturization, and indicate some areas where research is needed.

Before proceeding, I would like to present the definition of simulation that we will be using. Simulation is a physical, procedural, or symbolic representation of certain aspects of a functioning system (Fitzpatrick, 1962).¹ Simulation then is a working model or representation of a real world system.

Slide 2 (Applications of Simulation)

Applications of Simulation

There appear to be four basic areas of endeavor where simulation techniques have been applied (Crawford, 1965; Gagne, 1954; Smode, et. al., 1962). These techniques have been frequently used in the area of training. In this area, the objective of the simulation is to provide the trainee with a learning environment which will facilitate the acquisition of the knowledge and skill required to function effectively in the system being represented. The most crucial aspect of this application is creating conditions which will provide transfer of training to the real world system.

Performance measurement is the second major area where simulation

¹ The definition of simulation given by Fitzpatrick has been slightly modified to meet the needs of this paper.

has been found useful. The purposes of simulation in this case are to determine the limits of proficiency, criterion levels of performance, research requirements, and training needs. The measurement conditions created must also provide reliable and valid estimates of performance which may be generalized to tasks and functions in the real system.

Simulation techniques have also been used for system evaluation. The feasibility and capability of the system to meet its objectives are relatively simple to evaluate in a simulated environment. The effectiveness and contribution of certain subsystems and system modifications may also be determined in addition to the overall effectiveness of the system.

The last area where simulation techniques have found considerable use is for research purposes. The simulation in this case provides a controlled environment in which most parameters affecting the system may be examined, quantified, and controlled. Since these activities will be continually introducing change in the system, a constant check must be maintained on the extent of transfer of the findings.

Although these four areas do possess certain unique characteristics and impose specific requirements on the creation of the simulation, they certainly are not independent. The purposes of simulation for any given system would very likely include most if not all of these areas.

Slide 3 (Reasons for Simulation)

Reasons for Simulation

Why do we use simulation techniques in our activities as opposed to other methodologies? In many cases, the very nature of the system we are dealing with dictates that we use some form of simulation (Baker and Warnick, 1970; Redgrave, 1962; Rogers, 1959). The cost and time involved in operating large military or industrial systems are simply prohibitive. Due to the amount of equipment and the number of personnel required, we must turn to simulation techniques to make time and expense factors manageable.

Other systems may be too dangerous to exercise in the real world. We cannot use the real world system to learn to hit aircraft with air defense weapons. Through the use of simulation for training, however, many of the skills involved can be raised to a high level of proficiency.

Ethical and political positions restrict the use of other systems in the real world. A soldier cannot be placed in a live combat situation

simply to study the effects of stress on performance. The combat conditions which will produce this psychological state must be approached through simulation.

It is also necessary to use simulation techniques if we are to examine the effects of past events or conditions on a new system, or if we are going to predict the effects of future events. Hypothetical events or conditions must also be simulated if we wish to determine the reactions to unfamiliar situations and completely define the capability of the system.

Other systems such as those involving the accuracy and performance of air-to-air missiles are extremely difficult to control in the real world for experimental purposes. In order to precisely control and measure the variables involved in these systems, we may again turn to simulation.

Slide 4 (Advantages of Simulation)

Advantages of Simulation

There are several other advantages in the use of simulation which may provide sufficient justification in themselves to select this particular methodology (Baker and Warnick, 1970; Bogdanoff, et al., 1960; Rogers, 1959; Smode, et al., 1963). Simulation provides an excellent environment for training personnel to function effectively in a system. Many of the variables in the learning environment may thus be controlled and measured by the instructor so that he may make adjustments in the programs to meet the individual needs of the trainees. In addition, the simulated situation will provide the trainee with immediate knowledge of results without the detrimental consequences of his actions in the real world.

Another advantage of simulation is control over the dimension of time. In the case of rare events or situations which develop slowly such as large scale air defense engagements or tactical exercises, we may speed up the process to make the time frame for observation more suitable for our purposes. Likewise, for events which occur too rapidly for accurate observation and analysis such as complex psychomotor performance, we may slow down the sequence of events to a more practical rate.

Precise control over situational and experimental variables is another important advantage associated with simulation techniques. This allows us to evaluate experimentally the variables related to the simulation technique itself and also various aspects of the system being simulated. We may also introduce other variables which might otherwise be difficult to control or administer.

Simulation also makes possible a relatively unlimited number of replications under the same or different conditions in order to develop predictive relationships concerning the performance of the system.

Simulation techniques also provide the capability for economically testing and evaluating system performance during exploratory and developmental stages. In vehicle design, several control functions and configurations may be evaluated in terms of operator capability. In this manner, proposed changes or additions to the system may be evaluated before final development and production. These techniques also allow us to identify and define training problems at an early point so that the necessary modifications may be incorporated during the development phase. During development or operation, we may also extract certain subsystems, aspects, or components of the system for test and evaluation.

Simulation also assists us in simplifying the complex environments within which some systems must function. We may extract the most relevant variables from the environment for incorporation in the simulation, or we may systematically vary different combinations of environmental variables.

Slide 5 (System Aspects)

System Aspects

Now that we have made the decision to use simulation techniques either through necessity or to obtain certain advantages, we must now determine what should be simulated. In order to decide what aspects of the system we will simulate, we must have a thorough understanding of the total system and how the various aspects relate to each other and to the system. Fitzpatrick (1962) has proposed a taxonomy of system aspects which seems appropriate. The equipment components refer to the hardware associated with the system or its subsystems and subcomponents. The personnel are all the people included in the system and their respective job responsibilities and functions. The organization includes both formal and social relationships and interactions between groups or individuals. The procedures and processes of the system refer to the rules by which the system operates. Input data are those which provide the necessary and sufficient basis for system operation. The products which the system has been designed to produce are regarded as output data, and the quality of these data will form the basis for determining the adequacy of the system. The environment is intended to include all other variables and situations which are not a part of the system but which form the operational setting for the system. Before proceeding with the construction of a simulated system, it is necessary to have complete and accurate information concerning the aspect of the

system being simulated in order to place it in the proper perspective.

Slide 6 (Simulation Definition)

Simulation Definition

Since we have now selected the methodology of simulation and determined the general area of interest within the system, a definition of simulation is required. Once we have operationalized this definition or specified the procedures to be used in making our observations and measurements, the simulation will be complete. One of the simplest definitions I have found is that simulation is a physical, procedural, or symbolic representation of certain aspects of a functioning system (Fitzpatrick, 1962). Simulation then is a working model or representation of the system, and it is assumed that the observations made can be transferred to the real system in the form of predictions about its performance. Our definition of simulation contains several items which require further specification before we may construct the simulation. Physical, procedural, or symbolic refer to the general type or form that the simulation will take. Representation is probably the most critical word since it has direct implications for the degree of transfer to the real world. It refers to the fidelity of the simulation or the extent to which the average state of the system is represented. Aspects refer to the part of the system we are simulating and functioning indicates that we will conduct our activities within an operational and active system.

When we use simulation techniques, it is our intention that the observations and findings will transfer and apply to the real world system. Since this is our ultimate purpose and objective, defining the conditions of transfer becomes the most important phase in the use of simulation techniques. The degree of transfer appears to be directly related to fidelity or the extent to which we can accurately represent the system in our simulation. The fidelity of simulation is composed of both physical and psychological dimensions. Physical fidelity is concerned with the extent to which the simulation represents the environment and operational equipment of the real system. Psychological fidelity refers to the degree of similarity we can create in the psychological demands of tasks in the simulated and real systems. Several studies have indicated that psychological fidelity is more important for adequate transfer than physical fidelity (Cox, et al., 1965; Grimsley, 1969; Isley, 1968; Muckler, et al., 1959; Prophet and Boyd, 1970). Although it is probably true that high fidelity simulation is a necessary condition for transfer, it is a matter of which dimensions and attributes should be selected and how accurately they should be represented to obtain cost-effective transfer. In the development of any simulation, we must determine the levels of physical and psychological fidelity that will be cost-effective in terms

of the amount of transfer. For the most part, these relationships are unknown but it does appear that more emphasis should be given to psychological fidelity. A considerable amount of research is needed in this area in order to completely define the conditions of optimum transfer from simulated environments. In the absence of information concerning these relationships, there appears to be a tendency to request high physical fidelity as a precaution. In the majority of the systems, this is a fairly expensive safeguard of unknown value. The expenditure of funds to achieve high fidelity simulation probably far exceeds the amount that would have been needed for systems analysis and research to determine the levels of physical and psychological fidelity required for equal or better transfer.

Slide 7 (Types of Simulation)

Types of Simulation

Our first action toward implementing simulation techniques should be a determination of the general type of simulation to be employed. Harman (1961) has suggested several varieties of simulation which tend to vary along a dimension of physical abstraction from the real world.¹ The spectrum extends from a high fidelity replication of the system in the form of an operational model to mathematical modeling. Our task is to determine at which level of abstraction we can best represent all aspects of our system for cost-effective transfer.

Slide 8 (Psychological Dimensions)

Psychological Dimensions of Simulation

It appears that the conditions of transfer from our simulated environment will be primarily determined by an identification of the psychological dimensions involved in the tasks and the degree of fidelity with which they should be represented. Crawford (1956) has identified several relevant psychological dimensions of simulation. These include reactions to the general environmental stimuli, the duration of the interaction between man and environment, the degree of contact provided by the interface, the importance and degree of involvement

¹ Miniaturization has been added to the types of simulation given by Harman since it is not a complete replication due to the reduced-scale, but it is more than a laboratory simulation which seems to deal primarily with subsystems at lower levels of fidelity.

with interpersonal relations, and the extent of perceived realism and related cognitive states. We must now determine how the tasks observed in the operational system are related to these or other dimensions, and how accurately they must be represented in the simulation for optimum transfer.

Slide 9 (Conceptual Framework)

Conceptual Framework for Simulation

The following framework appears to us to provide both a review and a perspective for the points we have covered thus far. Listed on the lefthand margin are seven steps or decisions that must be accomplished to successfully apply simulation techniques and meet specified objectives in terms of transfer and cost. Listed at the top of the framework are the four areas where simulation techniques have been applied. These areas provide a definition of user need or the purpose of the simulation. Most if not all of these purposes probably would be included in the simulation of any given system.

A systems analysis will provide the basis for effective application of simulation techniques. The results of this analysis will consist of the performance requirements of the system and the necessary perspectives concerning the relationships between various system aspects. We must have complete and accurate information concerning the system aspect of interest before proceeding with the selection of system elements for simulation.

The next phase in the application of simulation techniques is the analysis of performance requirements and conditions of performance to determine where simulation will be most effective. We must examine these performances in terms of our cost and transfer objectives to determine if simulation will provide the most cost-effective approach. Other factors which may not be directly related to the costs involved such as the reasons for simulation and the associated advantages should also be considered at this point.

The most important step in the application of simulation is probably the selection of specific system elements for representation. Using those performance requirements where simulation will be cost-effective, we must now specify the critical knowledges and performances which should be included in the simulation. These knowledges and performances are all the psychological dimensions or attributes contained in the performance requirements which should be represented in the simulation for maximum transfer. Our objective is to determine which dimensions or attributes should be represented to achieve our desired levels of transfer at minimum cost.

In constructing our simulated environment, we must determine the levels of physical and psychological fidelity required in the simulation to accurately represent the critical knowledges and performances. The levels of fidelity selected must also be cost-effective in terms of the amount of transfer observed. When there is insufficient information concerning the required levels of physical and psychological fidelity, there appears to be a tendency to resort to high physical fidelity as a precaution. The purpose of high physical fidelity is to provide psychological fidelity for those perceptual and perceptual-motor tasks which are highly dependent on the equipment. In these cases, the added realism in the interface and task demands obtained through high physical fidelity will probably increase the levels of psychological fidelity. We must insure in our construction of the simulation, however, that high physical fidelity is an actual requirement related to the psychological dimensions of the performance. If high physical fidelity is included unnecessarily, it becomes very difficult to achieve cost-effective transfer. The compromises made between physical fidelity, psychological fidelity, cost, and transfer require constant and thorough evaluation to insure that the most cost-effective simulation has been attained.

The general form or type of simulation will determine how the psychological dimensions will be measured as outputs. In order to obtain accurate information on the degree of transfer, the methods used to measure the outputs must be valid and reliable with respect to the critical knowledges and performances.

In those systems where real world validation is possible, the extent of transfer will be determined by the terminal criterion performance. In the event that the degree of transfer observed is not acceptable, we must return to a more general level of analysis and question the adequacy of our decision concerning what to simulate at what level of fidelity.

Applications of Miniaturization

For the remainder of the presentation, I would like to discuss some of the practical applications of miniaturization techniques to various types of Army training. In general, these techniques have been effective and they have demonstrated the potential of miniaturization as a cost-effective training methodology.

Aircraft recognition is one area where miniaturized training has been successful in providing the required skills (Baldwin, 1970). After receiving classroom training in aircraft recognition, observers were given a field test in a miniature environment using 1/72 scale model aircraft. It was found that the slant range to the aircraft at the time of identification was not significantly different between groups that were field trained and those trained in the miniature environment.

Miniaturization techniques have also been found useful in tactical training for tank platoons (Baker, et al., 1964). It was found that personnel trained with the miniature armor battlefield and the armor combat decision game were superior to untrained subjects but they still required some field training to achieve a state of combat readiness.

Range estimation training for the purpose of determining the effective range of small arms has also been subjected to miniaturization (McCluskey, 1968, 1969). Observers were trained to determine the range to 1/48 scale model aircraft in a miniature environment and

Slide 10 (Miniature Ranging Apparatus)

then tested in a full-scale environment to determine the extent of transfer. It was found that the level of performance demonstrated at the end of training in the miniature situation transferred to the full-scale environment for those range determinations which were made when the aircraft was inbound. For the outgoing direction of flight, however, the judgments made in the field were under-estimates of the range requested whereas in the miniature situation these judgments were quite accurate.

The M16 has been recently fitted with a prototype of a laser training

Slide 11 (Laser Training Device)

device for test and evaluation. It appears that this device has considerable potential for simulating or miniaturizing numerous firing environments. The device was recently tested during some of the field firing exercises normally conducted in Basic Rifle Marksmanship. Four experimental groups fired six field exercises using either all ball ammunition, 1/2 laser firing and 1/2 ball firing, 1/2 ball and 1/2 laser, or all laser firing. It was found that there were no significant differences between any of the groups on their Record Fire I and II scores. This indicates that the laser training device may be used in place of live firing for 3 or 6 exercises without decreasing end of course performance.

In summary, these kinds of simulation and miniaturization techniques appear to have a great deal of potential for satisfying military training needs. Recognizing the current economic conditions and staffing levels, simulation may be one of the few cost-effective alternatives available to provide training for many of the systems. If we are to maintain high levels of training effectiveness and readiness, it seems that we must seriously consider the use of simulation. Before these techniques reach maximum levels of effectiveness, however, considerable amount of research is needed to define the conditions

of transfer to the real world. After a complete systems analysis to define the physical and psychological dimensions and relationships, the following research questions may be addressed:

1. What task and equipment aspects require high fidelity representation?
2. What are the most cost-effective levels of fidelity?
3. What is the most effective combination of simulated and real world experience?
4. What are the most effective scale factors for miniaturization?
5. What relationships exist between psychological fidelity and the scale factors?
6. What perceptual cues require high fidelity representation?
7. What relationships exist between the perceptual cues, scale factors, and the task demands?

As we begin to discover some of these relationships, simulation and miniaturization techniques should develop as some of the most cost-effective methodologies for training.

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- Slide 1 Perspectives on Simulation and Miniaturization
- Slide 2 Applications of Simulation
1. Training
 2. Performance Measurement
 3. System Evaluation
 4. Research
- Slide 3 Reasons for Simulation
1. Expense and time
 2. Safety
 3. Ethical or political constraints
 4. Past, future, or hypothetical events
 5. Control over real world events
- Slide 4 Advantages of Simulation
1. Excellent training environment
 2. Compress or expand real time
 3. Precise control of variables
 4. Replication
 5. Test and evaluation
 6. Simplify complex environments
- Slide 5 System Aspects
1. Equipment Components
 2. Personnel
 3. Organization
 4. System procedures and processes
 5. Input data
 6. Output data
 7. Environment
- Slide 6 Simulation is a physical, procedural, or symbolic representation of certain aspects of a functioning system
- Slide 7 Types of Simulation
1. Replication simulation
 2. Miniaturization
 3. Laboratory simulation
 4. Computer simulation
 5. Analytical simulation

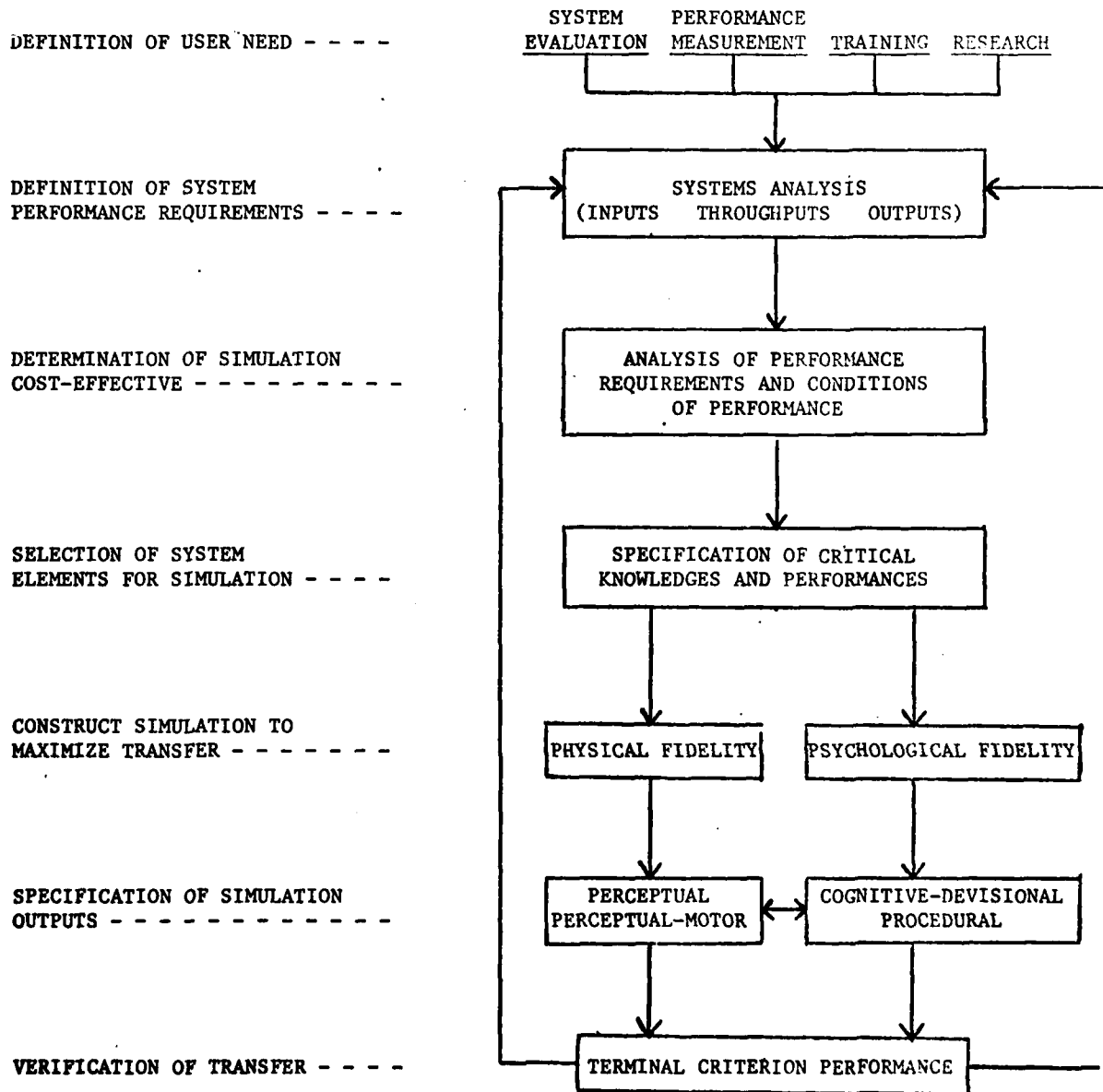
Slide 8

Psychological Dimensions of Simulation

1. The scope, extent, or segment of the environment represented in the simulation
2. The duration of the experience provided by simulation
3. The degree of mediacy between the person and the raw environment, in terms of both perceptual and effector interactions
4. The degree of centrality of interpersonal relationships
5. The degree of apparent cognitive involvement

Slide 9

CONCEPTUAL FRAMEWORK FOR SIMULATION



Slide 10

Photograph of the Apparatus Used for
Miniaturized Ranging Training

Slide 11

Photograph of the Laser Training
Device Attached to the M16

Combined Arms Tactical Training Simulator (CATTS)

by

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This briefing is designed to acquaint you with the Infantry School's Combined Arms Tactical Training Simulator Project commonly referred to by the acronym CATTS. This project represents the most ambitious and progressive study of battlefield simulation, and adaptive training techniques employing simulator devices ever undertaken by the United States Army Infantry School.

Our project actually had its beginning in March of 1969 when the Assistant Commandant of the Infantry School received a letter from a brigade commander in Vietnam suggesting the idea of a Command and Control Simulator. His letter expressed this requirement so well that I would like you to hear some excerpts from it at this time. This will serve the dual purpose of providing you an excellent summary of the requirement and secondly to put you where we were in March of 1969. (Film of brigade commander's letter - Incl 1)

The School's initial response to this request was to prepare a class on Command and Control Operations from an Airborne platform. This class was first presented in May of 1969 to Colonels and Lieutenant Colonels attending the Special Vietnam Orientation Course here at Fort Benning prior to assuming command of infantry units in Vietnam.

This class used all the facilities and training aids that were readily available at Fort Benning. The objective of the class was to duplicate to the maximum extent possible the stresses and pressures of a modern airmobile battlefield and to reduce that which the student must imagine to zero. The class was based upon a fast moving combat air assault situation in the Michelin Rubber Plantation in III CTZ (Third Corps Tactical Zone) in Vietnam. The students were seated behind the command and control radio console normally found in a command and control helicopter. They heard the entire class over headsets and were equipped with microphones permitting them to enter the play of the problem. In an attempt to present real time movement rates and an appreciation for the view from an Airborne platform, authentic combat films were used such as those which we present here (Vietnam combat film clip - Aerial View).

The main part of the tactical scenario was advanced through the use of vu-graph transparencies and 35mm slides such as this cut of a map sheet of the Michelin Rubber Plantation (Map Sheet Slide On) and this aerial view of the battlefield (Aerial View of Vietnam countryside). As a decision point was reached, a student was required to respond with his actions and orders. No longer are blatant generalities accepted, such as "I would consider moving Alpha Company from Point X and Point Y or perhaps lift or shift supporting fires." Instead, we insist that the actual orders needed to affect the move of Alpha Company from Point X to Point Y and to arrange for fire support to accompany to move be given.

The response to this class has been overwhelmingly favorable. Commanders have written back from Vietnam praising the class for its authenticity and its assistance in preparing them for their first fight in Vietnam. It also helps them learn to keep things sorted out as they manage not only the maneuver force in combat action, but the critical airspace management problem resulting from the simultaneous use of artillery, Air Force aircraft, gunships, and troop lift helicopters.

As effective as it was, we recognized that this class did not exploit the full potential or simulation as a training technique. Therefore, we began an investigation into the state of the art of simulation. We started at the Naval Training Device Center in Orlando, Florida, who in turn steered us to the educational and industrial leaders in the field. During our investigation, we quickly became aware that we were not only looking for better ways to simulate a combat environment but for a more effective and realistic adaptive training technique which could be used here at the Infantry School. It became obvious that a simulation training device could closely approximate or exceed the learning value which was derived from actual experience.

Along with the advantages afforded by simulation, we saw some obvious limitations. These would be times of reduced budgets - times during which the Army would be faced with the task of reducing our requirements for personnel, ammunition, fuel, and facilities. Therefore, any equipment which we developed as a result of this search would have to be more effective in a training sense and yet consume fewer resources in producing versatile, well-trained combat commanders and staff officers.

Keeping these points in mind, we developed the following purpose for our Combined Arms Tactical Training Simulator (Purpose Slide - Incl 2).

To accomplish this purpose we determined that the simulator should be able to perform these tasks (Tasks Slide - Incl 3).

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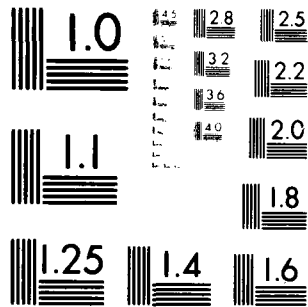
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Based on these tasks, we have organized our project into three stages which serve as developmental milestones. This framework gave us the flexibility of taking the experience we gained in the initial command and control classes and, through logical development, devise a detailed requirement for the final simulator device (Stages Slide - Incl 4).

The initial version of the command and control class for our Senior Vietnam Orientation Course was later expanded to include the Infantry Officer Advanced Course. Careful attention was given to improving the class throughout the period which it was presented. For example, combat films were incorporated which were especially taken of terrain around the problem site for our training program.

The development of stage two recognized the fact that it could be an extended period between the time we submitted the proposal for the training device requirement for our stage three product and the time a piece of equipment arrived at Fort Benning. We also needed an interim step in which to develop the training techniques and literature that would be required for a smooth transition into the third stage. We developed the idea of using a terrain model as the visual base of the problem instead of the film strips and photos of the area (Terrain Model Slide). Looking around Fort Benning, we found an old terrain model which we refurbished and a P. T. platform which was used to simulate the aerial vantage point (P. T. Platform Slide). The student commander operations officer and fire support coordinator, which represent a type command and control group, were seated on the platform behind a communications console. Assistant instructors, located beneath the platform responded to the radio calls of students and developed the tactical scenario by playing higher, lower and adjacent headquarters.

A two-hour experimental class was developed in order to determine whether the terrain model provided an improvement over the stage one class and whether it provided a logical step in the sequence of instruction between the stage I and stage III products. The answer to both of the questions was a resounding "yes." Even more impressive was the fact that students participating in the class requested to come back after duty hours for additional instruction.

We were so pleased by the results of our investigation that we have integrated these exercises into the regular advanced course curriculum. We have expanded and improved this facility to include four of these simulators. (Helicopter Mock-Up Slide) A helicopter mock-up has been added to increase realism and a seat has been added for the air mission commander.

The actual AN/ASC 15 (AN/ASC 15 Slide) command and control console has been replaced by a closed wire circuit mock-up that functions as the actual equipment. Each of the four simulators contains a different terrain model, which corresponds to an actual 1:50,000 scale military

map. The types of terrain are:

Jungle - In the area of Song Be, Vietnam (Jungle Slide)

Mountain - In the area of Uijongbu, Korea (Mountain Slide)

Desert - In the area of the Suez (Desert Slide)

Canal and gentle rolling terrain, in the area of Bamberg, Germany (Gentle Rolling Slide)

A variety of tactical scenarios have been developed for each of these battlefields. To reduce the requirement for instructors to describe the function of the simulator and its special equipment and to develop the general and special situations that create the background for the tactical scenario, an automatic briefing center was developed (Student Briefing Center). This center uses pre-recorded tapes, electronically connected to a slide projector to present a pre-mission orientation briefing.

As far as stage III is concerned, we prepared a formal Training Device Requirement (TDR) and forwarded it to Headquarters, Continental Army Command.

The document has received favorable support from world-wide staffing and was forwarded to Department of the Army (ACSFOR) by CG CONARC on 20 August 1971 with a recommendation for approval.

The concept for the final configuration of the Combined Arms Tactical Training Simulator which is outlined in the Training Device Requirements is shown on this slide which is an artist's concept of a possible configuration for the CATTs (CATTs Concept Slide). Within the overall system are four basic subsystems.

The first of these is an audio subsystem. This would duplicate the high speed radio chatter that a commander hears as he conducts a combat operation. From an equipment viewpoint this system consists of a replica of the communication console found in the command and control helicopter.

The second subsystem is a visual display system. This would give the student a realistic view of the battlefield and the progress of the operation to include troop lift helicopters, gunships, air and artillery preparations, and other occurrences which are normally seen from the command and control helicopter or ground command post. We feel he will be able to see these in a reasonable approximation of 3 dimensions and color.

The third subsystem is the computer program which drives the audio

and visual subsystems. This system allows the instructor to portray a tactical situation, enter the student's decision, and access and portray the results of the decision in the audio-visual system.

The fourth subsystem is the physical environment of the command and control group. Here, for example, is pictured the command and control helicopter as a type command post.

This may seem to be a somewhat ambitious concept; and to reassure you, let me at this time give you a review of some of the technology involved in simulation training. I'm sure that the first thing which comes into everyone's mind is the link trainer of the World War II era (Link Trainer Slide). As you recall, this was a crude approximation of an aircraft with a rudimentary set of controls on which a student pilot could train and qualify for an instrument rating.

Simulators have progressed a long way since this early link trainer. Here is the latest in "Flight Trainers" as they are now called (Boeing 747 Simulator Slide). This is a simulator for a Boeing 747 which provides a means to train pilots to take off and land under normal and restricted visibility conditions. This again includes four subsystems. The module subsystem contains duplicate controls as in an actual Boeing 747 aircraft. This simulator has a 6-degree of freedom motion subsystem which permits the pilot to put the simulator through any maneuver which could be accomplished with a real 747. The controls of the aircraft are linked to the aircraft by the computer subsystem. The visual subsystem is perhaps the most interesting. Through a set of previously prepared film strips the pilot can be trained for any airfield in which he might be expected to operate at a later date. An example of this is a pilot being trained for the New York to Frankfurt run. He can get into the simulator and see what he would expect to see at the John F. Kennedy Airport in New York, taxi out and take off from there. While flying the transatlantic flight, he will encounter all the difficulties that he would expect to encounter in such a flight. In Germany he would come under control of the Frankfurt Rhein-Main Airport Tower and land the simulator at what appears to be Rhein-Main Airport in Frankfurt. All of these subsystems are linked by an executive computer program and all subsystems are updated thirty times a second to simulate an actual flight.

The overall system is so effective that the Federal Aviation Agency has allowed 92% of a pilot's qualification training to take place in the simulator, thus only 8% needs to take place in the aircraft itself. The cost rationale in support of simulation becomes quite evident when you compare the operational cost to train a student pilot with a real 747 of approximately \$4,000 per hour with the \$400 per hour cost of operation for the simulator. Aside from this distinct cost advantage, certain intangibles such as the reduction in accidents

must also be considered.

The next slide shows an application of simulator technology to a military requirement (Synthetic Flight Simulator Slide). The synthetic flight training system which has been accepted by the Army is being used to train four helicopter pilots simultaneously by one instructor. This system has recently been installed at Fort Rucker, Alabama.

As you will recall, I mentioned that there were four subsystems involved in the CATTs concept. From an equipment point of view, the audio system is very easily constructed. It consists of a replica of a communications console in a command and control helicopter or ground tactical command post, and the system which we developed for our stage two is fully responsive to the requirements of the final system for the airborne mode. The ground mode is even less of a challenge. Likewise, the construction of the physical environment presents no significant challenge. It is in the visual and computer program subsystems that the real technological challenges lie. What we will do now is show you some bits of technology which have been proposed as solutions to our CATTs problem.

The first of these concepts uses computer generated imagery. This slide shows an illustration of a concept which was proposed for a Cheyenne Helicopter Simulator (Cheyenne Slide). In the center you see the flight training module. The imagery you see on the parabolic screen is projected through the television projectors which are in turn driven by the computer. In this technology each one of the straight lines, planes, and colors which you see in the scenery is registered in the computer's memory as to its exact location and nature. Also registered in the computer's memory is the initial point on the flight path of the training module. As the student pilot manipulates the controls, a flight path is described to the computer. At a cyclic interval the latest point is computed and the pilot's view is updated. This means the pilot can fly around with complete freedom anywhere within the environment that you see here. For example, he can fly to the other side of those hills and look back and see the correct perspective. This also gives the pilot the freedom to locate, attack, and destroy enemy targets such as this tank in the lower left hand corner. Despite the fact that the scenery that you see is somewhat like animated cartoons, this freedom to fly around anywhere in the environment makes for a very realistic training exercise.

What you have seen so far is a static display of computer generated imagery. At this time you will see a film prepared by a leading company in computed visuals. This is a possible solution to the CATTs problem of simulating the visual environment. The plot for this film is an air assault of the Syracuse, New York Airport. Full-back 6 is the battalion commander. The film begins just prior to dawn. The air assault is scheduled for immediately following first

light. The conversation you will hear is somewhat garbled at first in the film. It begins with the battalion commander talking about a B-52 strike which will start with a series of small white light flashes in this long wooded area in the lower left to upper right (film showing computerized visuals).

The fiery finish was entered into the film for two reasons. First, it shows that a student must be given the flexibility to place himself in the correct position to maximize his ability to command and control the operation. Secondly, it shows that if a student makes a mistake, he must be held accountable for it as was shown. If, for example, the student entered the effective range of a machinegun with his helicopter, the probability of a detection and hit must be assessed by the computer program and those probabilities incorporated into the development of the situation.

The next piece of technology which we would like to show you concerns the computer program (War Game Slide). On this slide you see a student playing a war game directly with a computer. The company which has this technology has been closely associated with the STANO projects in the last few years. Through this association the company has developed a library of mathematical models to reflect realistic weapons effects, troop movements, enemy characteristics, etc. An executive program was designed which combined several of these models into computer subroutines so that a student can play the war game directly with the computer using only the interface of a cathode ray tube.

On this slide you see the student playing a perimeter defense program. The student can enter his decisions into the system with the light pen or the keyboard which you see. In this system the student will enter the tactical play of the program by making a decision, for instance, to shift the strike of artillery fire impacting at Point X to Point Y. The computer program will accept this decision and affect the movement of the fires. It will then search its other tactical parameters to see if there are enemy at Point Y, what their disposition is, whether they are prone or standing, in the open or in foxholes. An assessment is made according to a probability scale to determine casualties against that enemy. The results will be displayed on the cathode ray tube. We have a short film clip which better illustrates how this system operates (film clip showing use of cathode ray tube).

I think you can see how the marriage of these bits of technology can be applied to solving our CATTs requirement. Thus far, you have only seen concepts developed by two companies. There are other companies which have advanced concepts and these have given us a general idea as to what a CATTs might cost. They run from a low of one million dollars to a high of two and a half million dollars. Although this is a wide range, they have allowed us to address the problems I posed earlier; that is, aside from the training effectiveness

will the CATTS provide us with an advantage in the expenditure of resources necessary to reach the training objective. As I also indicated earlier, this is a very difficult problem because it involves many intangibles not the least of which is human life. Although we know intuitively that better training saves lives, for the purposes of an economic analysis it is almost impossible to prove conclusively that Private Jones' life was saved on December 24, at 0830, at Point X, and this was due to training that his commander received on the CATTS. But despite these problems we have come up with what we feel is a logical and reasonable approach to looking at the economics involved in this simulator. This problem formulation revolves around acceptance of a relatively noncontentious training objective. That is, that we need to give our commanders better training. Now, if we can accept this as a valid training objective, we can then look at the alternative means of reaching this training objective and comparing the costs implied by each. We came up with at least three techniques through which we could reach this training objective. The first would be to train as we do now - that is, after the man gets to combat. The second technique would be to train using live exercises in something other than a combat environment. And the third, of course, would be to acquire and operate the CATTS.

Now, for the first of these techniques--training after we get to combat. We really do not know the full impact of cost which results from doing our training in this fashion. But let me point out some of the things that are involved. The cost of the resources could be double, triple, even quadruple those in CONUS because of the transportation complication in getting the resources from CONUS into the combat theater where they will be used. When you couple this with the fact that there is unquestionable increased risk which accrues because of doing this training in a combat theater, it is relatively obvious that training should be done in the continental United States or in some place other than the combat field. But even in CONUS this training will be expensive. If we use live exercises to reach the training objective, the costs would be something on the order of those shown on this slide (Cost Slide 1 - Incl 5).

This slide shows the cost of an insertion and extraction using a rifle company as the exercise unit and using commonly accepted airmobile tactics and techniques. The high cost itself carries a special significance. First, it means we must hold this training down to the absolute minimum necessary to effectively train prospective commanders. In designing what we consider to be a marginally adequate program of instruction we could give each student an opportunity to command one live insertion and extraction using the rifle company as an exercise unit for approximately those costs shown here.

The second thing this means to us is that we must limit this training to only those officers who have actually been designated as commanders.

1 Assuming a post Vietnam Army of ten to thirteen divisions, we feel that we would have an annual requirement of approximately sixty of these officers (Cost Slide 2 - Incl 6). Therefore, the annual requirements when combined with the unit cost of instruction would yield the annual cost of achieving the training objective through the use of live exercises which looks like this: approximately eight million dollars per year.

Now let's look at the cost of acquiring and operating the CATTs and, for the purposes of the problem, formulation. We have assumed a ten-year system life which we feel is reasonable. We have included the cost estimate that we received from AMC which was 3.6 million dollars as the initial acquisition cost plus ten years of equipment rental and maintenance associated with the operation of the system. When this is annualized over a ten-year period, we come up with a cost less than one million dollars per year (Cost of ACCS Slide - Incl 7). I would hasten to add that the use of the CATTs has several attendant advantages. First, we do not have to limit our training to just commanders. We can train commanders, staff officers, company commanders--even platoon leaders, in some instances.

Second, we don't have to limit our training to one exposure to the problems of command and control. To the contrary, we can give each student many exposures in different types of problems. Finally, we feel that the use of the CATT would allow us to eliminate some of the high cost problems currently present in the instruction here at Fort Benning. And, although we cannot designate these specific problems at this time, we feel the savings involved here could amount to as much as one million dollars per year (Conclusions Slide - Incl 8). Through this cost effectiveness reasoning, we reached these conclusions.

Actually, in this case cost effectiveness reasoning is somewhat academic. The hard facts of the matter are that we have not been giving our airmobile commanders the training they should because of the exorbitant costs of using live aircraft. What we are trying to do here is to develop the equipment and training techniques which are necessary to achieve this vitally important training objective before our commanders get to combat. Then, too, there is a time sensitivity involved with the problem. That is, if we continue to train as we do now--that is, after our people get to combat--as the war winds down in Vietnam, our reservoir of trained airmobile commanders will dry up and our storehouse of airmobile knowhow will begin to evaporate through retirements. Therefore, we feel it is mandatory to acquire the equipment and develop the training techniques necessary not only to preserve but to perpetuate our reservoir of airmobile knowhow without delay. We would also like to correct a common misconception; that is, that the concept of airmobility is applicable only in a jungle, counterinsurgency environment. We feel this is far from the case.

Although the Vietnam war has been its latest manifestation, airmobility is not applicable only to, nor will it end with, the war in Vietnam. The Combined Arms Tactical Training Simulator supports the doctrine of airmobility in this larger sense. It represents a continuing need which is broader than the war in Vietnam.

In order to increase the viability of the project and assure funding at the earliest possible time, the scope of the program was expanded beyond the immediate and most demanding need for simulation of the airborne command post environment and the project phased to provide for the development of a Phase 1 demonstration model which would cost less than one million dollars (Phase 1 Slide). This artist's concept portrays the essential components of this design. As you will notice, the physical environment is structured for a ground command post environment and the visual system consists of an automated, two-dimensional situation map. The cost reduction required a severe reduction in the capabilities of the visual subsystem. This austere demonstration model will, however, provide an experimental tool that will enable us to reach greater perfection in the development of follow-on configurations and assist us in opening the doors for better training.

"Last night the thought came to me that we need a simulator, for want of a better term, for training our battalion commanders. The Air Force has simulators for the C130 and C141 in which student pilots can fly entire missions from takeoff, through cross-country, to landing. Everything, including time, is real enough to be meaningful. From the pilot's cockpit in the simulator, he sees the runway, the countryside below him, and the terminal airfield all at the proper time. This is not exactly what we need, but it is along the right line.

"We should put a student battalion commander in the observer seat of an OH6 simulator, a pilot next to him, and an S3 in the back seat. We should have a similar simulator for the Huey command and control ship. The student should plan an insertion and extraction. He should go airborne and coordinate the air and artillery preparations, the gunships, the insertion and extraction. He should have a hot LZ and a hot PZ at some point (these are a real shock, as you know, and require lots of cool to handle properly). He should maneuver troops in contact from the air, run artillery blocking fires, run dustoffs, run resupply, contend with a brigade and division commander, and decide when to put himself onto the ground to command. He should experience the physical drain of hours in tight orbits, should learn to quickly brief the brigade commander who can take over while he refuels, eats, tends to other necessary matters, or operates from the ground where he initially senses a relative feeling of loss of control.

"There must be a better way to prepare our battalion and lower commanders with this new thing, airmobility. Some kind of simulator system is the answer, but exactly how it works and how it uses simulator technology will require sophisticated thought and money. Quick-minded men with good background exposure to tactical matters learn the airmobile trade fast, but such men are fewer than one might think. We need to bridge the gap between theoretical and actual application of airmobility and reduce the price of learning the hard way."

PURPOSE

TRAIN AND EVALUATE THE PERFORMANCE OF POTENTIAL
COMBAT COMMANDERS AND KEY STAFF OFFICERS IN
APPLYING TACTICS AND TECHNIQUES REQUIRED FOR
SUCCESSFUL COMMAND AND CONTROL OF COMBAT UNITS
ON THE BATTLEFIELD

INCL 3

CATTS TASKS

1. ACCOMMODATE A STUDENT TEAM CONSISTING OF A COMMANDER, OPERATIONS STAFF OFFICER, AND FIRE SUPPORT COORDINATOR.
2. PERMIT A RECONNAISSANCE AND DEVELOPMENT OF A TACTICAL PLAN.
3. ALLOW EXECUTION OF THIS PLAN.
4. PRODUCE AUDIO AND VISUAL STIMULI WHICH WILL REQUIRE THE TEAM TO REACT AND MAKE DECISIONS.
5. REQUIRE A CONTINUING ANALYSIS OF THE SITUATION.
6. ALLOW FOR EVALUATION OF THE STUDENT TEAM'S PERFORMANCE.

INCL 4

CATTS STAGES

1. COMMAND AND CONTROL CLASSES FOR SPECIAL VIETNAM
ORIENTATION COURSE AND INFANTRY OFFICER ADVANCED
COURSE.
2. SIMULATIONS USING TERRAIN MODELS.
3. SOPHISTICATED TACTICAL TRAINING SIMULATOR.

V-132

**COST OF A TYPE
INSERTION/EXTRACTION**

INSERTION

\$95,987.70

EXTRACTION

\$39,490.30

\$135,478.00

ANNUAL COST TO ACCOMPLISH TRAINING OBJECTIVE

USING TIME EXERCISES

COST OF A TYPE INSTRUCTION EXTRACTION 5 1135 475
 TIMES 60 STUDENTS PER YEAR 5 811248 6810

ANNUAL COST OF CATTS

EQUIPMENT:	\$3,600,000
MAINTENANCE:	
\$12,000 PER YEAR x 10 YEARS	\$120,000
EQUIPMENT RENTAL:	
\$12,500 PER MONTH x 10 YEARS	\$1,500,000
TOTAL 10 YEAR COST:	\$5,220,000
TOTAL ANNUAL COST:	\$522,000

INCL 7

CONCLUSIONS

1. TRAINING EFFECTIVENESS OF THE SIMULATOR EQUALS OR EXCEEDS THAT OF LIVE EXERCISES.
2. CATTS OFFERS COST ADVANTAGE OVER LIVE EXERCISES AND TRAINING IN ACTUAL COMBAT.
3. SIGNIFICANT COST SAVINGS MAY BE POSSIBLE THROUGH ELIMINATION OF COSTLY DEMONSTRATIONS AND OUTDOOR INSTRUCTION.

Discussion Resulting from the Presentations in Workshop Session #2,
"Miniaturization, Simulation and Simulators"

Discussion Leader: Mr. Richard S. Kneisel, Education Advisor,
United States Army Infantry School

Mr. Kneisel: Do you have any questions that you would like to address to either of the presenters or any other points that you might want to get at with regard to simulation, miniaturization, and simulators?

Dr. Ronald W. Spangenberg (HumRRO Division No. 2, Fort Knox):

I would simply like to make a statement that the Army has representation at the Naval Training Devices Center, Orlando, Florida, which can give advice in this area. There is a handout in the back of the room that you can pick up concerning the organization of this organization.

Mr. Kneisel: OK, fine. Any other questions?

Mr. Ray Stoddard (Charleston, US Navy): I would like to ask Captain Amos if the Infantry School has checked with the Air Force and the Navy about their costs of their simulators?

Captain Albert R. Amos (US Army Infantry School): Yes, we have. As a matter of fact, we have made extensive travels and coordination with the Navy and all the sister services--for example, we have visited the Submarine Warfare Simulator, at Norfolk, which is similar to the one you have on the West Coast, in San Diego; and have made extensive investigations throughout the services, concerning the cost for simulators and cost differentials between simulation and actual training on actual equipment.

Mr. Stoddard: I was just thinking that, based upon what has already been spent and justified--maybe by Army Aviation as well as the sister services--I think you have a strong justification for this. And I think you could get your simulator size up there. I think it could be included based upon what you've gotten here this week--the accountability and cost effectiveness, where you have the possibility--and, hopefully, that it will be taken out of there because I think that you could prove efficiently that you can save. I really think you could.

Captain Amos: I have a cost rationale for our program with me here which demonstrates fairly clearly the amount that we envision we can save the Government by using simulators instead of live exercises. I would be happy to show these to you during the break.

Mr. Kneisel: Fine. I think that one of the points that you made, Mr.

Stoddard, which bears emphasis and is one of the reasons for being together here in this workshop is, namely, that many of the activities which the other services are doing ought to come together because the technology and state of the art type of things that are being developed down separate rows by various agencies can be pulled together and a lot more cost effectiveness can be derived from that. I think that is one of the objectives of our getting together, hopefully, to exchange some information. The Marine Corps, at Quantico, for example, is developing a simulator model that has some of the same lines as the US Army Infantry School has in mind in developing its model. Let's see if we have any other questions from any of you who would want to interact with the presenters, Dr. Briggs, or even with yourselves.

Colonel Frank H. Duggins (Office of Chief Research and Development, DA): It's a question which won't appear anywhere else in the workshop because there's nobody else to speak for it. It's the matter of financing simulation. The Army's problem is: "We ain't hardly got any simulation." We have the SSTS and we have the RED EYE trainer. And this is in no way critical of the USAIS Combined Arms Tactical Training Simulator. But we have been able to convince the Army staff, the DOD staff, and Congress to give us a modest increase in resources for simulations, non-systems oriented, not oriented on a specific piece of hardware, for FY 72. We think we will be able to get an increase in FY 73 but if we are going to do anything with simulation, we are going to have simulators that don't have high fidelity, that have high density, do something for large numbers of soldiers, that come off the shelf, that can be moved around, that aren't required at a specific installation, and that are cheap and easy to service. And these can be done. One application that our R&D has suggested by the Requirements people in the school's division is driver training. Now, some of the skills we want to teach drivers are not equipment dependent and there's a whole technology of driver simulation done up in the high school in the civilian educational system which may have application in the military. We have another one on ground air gunners and the RED EYE simulator costs about three million dollars to R&D, something like \$500,000 a copy which trains roughly ten gunners per battalion. The Army's problems today are not in the school system although the schools have plenty of problems. The one area we have not been criticized--if you exclude the teaching of ethics as a result of the Vietnam war--is in poor instruction. But our problems are in the field, particularly in training the troops in the field and retraining and keeping them productively busy. So, if we are going to do anything in simulation, we are going to have to develop some requirements to train troops in the field. Instead of taking troops from the field, bring the simulation to the troops, from one station to another. Tracked vehicle drivers is another one. We have no simulation known to me with regard to communications for small units--squads, platoons; a CPX, if you will, for the

combined arms team. These are very simple things to do. The technology is there. They require no basic research really. We're going to have to produce some of these and field them if we're going to get more money for a more complex and necessary simulation, because the SSTS and the RED EYE will produce in a time when we have large budgets. And those times are over. So, that's sort of my message.

Mr. Kneisel: That's a good message.

Colonel Duggins: There's one thing it's necessary for everybody to know. We must get something out to the soldier who represents a vote to his Congressman. The combat leaders may represent a whole series of votes to his men and at battalion level simulators used by officers are necessary, but we must get simulators down to the lowest level to make for maximum utilization.

Mr. Kneisel: That's one of the reasons why we tried today in our presentation to give the two perspectives. Perhaps there are two answers to this simulation business and that did not come through too loudly and clearly; but we tried to show with the laser beam rifle, for example, that a simulator at that lower level of the drill instructor, so to speak, and with this Combined Arms Tactical Training Simulator we have a more complicated system, recognizing full well that there may be a spectrum from the rifle to the computerized CATTS system. It appears from Colonel Duggins' remarks, however, that we may have to be devoting most of our money and energy at the lower end of the simulator spectrum.

Mr. Clarence Jeter (US Army MP School, Fort Gordon): In thinking of simulation and trainers some consideration must be given, in the same point of time when you're thinking of cost effectiveness, to its long-range effect in training. When you train a battalion commander, using this CATTS simulator, its effectiveness is on large groups of soldiers so, therefore, it may be putting a lot of your money there at first but in the long range it will affect more people than any other way. My point is exactly in your argument: "What gets money to do that?" I am in perfect agreement with you. It's one thing for a hands-on for a battalion commander and it's another thing for hands-on for a sergeant.

Mr. Kneisel: We have, then, Colonel Duggins, to be smart and diplomatic in all these actions to get at what works to get these training devices in being. We have to figure out exactly what you are trying to say so that you can "sell" the program. We went through this on cost effectiveness. These very things came up. I think what we are saying is that we have to walk before we run. We have to convince the decision makers and money men that we are addressing the problem at the right level. If we're not careful, we will lose the

ball game by trying to do something that's just too ambitious.

Dr. Edgar Smith (Air Force Systems Command, Lowry AFB): Turning to your last generalizing on that. Has anyone attempted to let the two men fight against each other--or the two teams fight against each other--so that you are fighting twice as many men with much less computers?

Captain Amos: As a matter of fact, we have a two-sided computer supported war game at the Infantry School now. We try to modify this so as to increase the use of the facility as well as stretch the grey cells of the students. Also, in field problems we use the opposing forces concept where students play the attackers and the defenders.

Mr. Kneisel: You are training the friendly forces by forcing the student to be both a friend and an aggressor?

Captain Amos: Yes, sir. We have the RED side and BLUE side and use the computer to make it as realistic as possible.

Colonel John S. Holeman (US Army MP School, Fort Gordon): We've got two extremes: the large-scale decision making and the small-scale skill. What do we have in between these two--somewhere where the man is using his knowledge to make decisions? What do you do in a small systems area like comparing a communication system something along these lines for simulation? These exist. What is the hardware that is available at the present time?

Mr. Kneisel: Personally, I'd rather not jump in there too fast but I'd say they do exist. I think the Signal people can help us on that because there are a lot of these sorts of simulators about. I believe the Missile people, too, have some devices in this category, but I am just taking that sort of off the top of my head. Do we have anybody who can address that in the audience today? Colonel Duggins?

Colonel Duggins: A little bit. NTDC (Naval Training Devices Center) told us last week that all the services are remiss, that their simulations in their (NTCD) view have over the years been operator oriented and there are few simulations in any of the services that are maintenance oriented. That's just a sort of a gap that's sprung up--lower level decision making. There is not too much in the simulation area.

Mr. Kneisel: That may point up a need here that we ought at least to address somewhere in the system. Maybe this is one of the things that might come out of the workshop such as this sort. We may need to have more of the decision making simulation directed at the lower level decision maker.

Mr. Albert H. Mencken (US Army Southeastern Signal School, Fort Gordon): Fort Monmouth has COBET II which addresses this with electronics training. The electronics training concept in this CONARC Workshop has been slipped in with the computer in training session and has been discussed in one of the other specialty areas of the Workshop. This type of simulation addresses the issue we've been talking about. This workshop session is on the second floor of this building--the computer workshop.

Captain Amos: I would just like to make one comment in response. This CATTs is a starting point for us at the Infantry School. We also envision this simulator as a decision trainer for the combat leaders going down to company, platoons, squads, etc.--a starting point. The most critical training need as it lies right now seems to lie in the system development.

Mr. Kneisel: There are some decision making simulations that are in computer exercises but I don't think that's what you had in mind. You were talking about, as I gather, more of a real world type of simulator that calls for on-the-spot decisions.

Colonel Duggins: There are some maintenance-type situations where a man has to evaluate a system to make a decision as to which way he goes, which make the strategy. He's actually working with the simulation of a piece of equipment.

Mr. Kneisel: Fine. Any other questions? Any other comments you would like to make now? Dr. Briggs, do you have anything you want to add to this session or any final words of wisdom for us?

Dr. Briggs: I think about the only comment I have on this latter point about simulators for maintenance training--certainly there is a lot in past history and the records that can give us some data from the Air Force and the Navy, and perhaps the Army as well--certainly, there is a large amount of literature on what can be done and what has been done in providing low cost, shock free simulators to get at other characteristics in maintenance training.

WORKSHOP SESSION NO. 3
LEARNING CENTERS

Individual Learning Center at the US Army Infantry School*

by

Major Howard S. Stanfield
Office of the Director of Instruction
US Army Infantry School
Fort Benning, Georgia

Good morning, Ladies and Gentlemen. I am Major Stanfield, Chief of the Instructional Innovations Branch, Instructional Methods Division, located in the Office of the Director of Instruction, United States Army Infantry School, Fort Benning, Georgia, and my report will be on the School's Individual Learning Center.

(Slide of USAIS Individual Learning Center)

At the present, the USAIS Individual Learning Center consists of thirty individual student carrells equipped with a variety of multi-media presentation devices including tape cassette players, 35mm slide projectors, educational television and super 8mm motion picture projectors. The ILC is located in the academic wing of Infantry Hall in a converted 50-man classroom.

(Slide of USAIS Mission)

The mission of the Infantry School is to produce the world's finest infantry combat leaders. To achieve this end most career officers will be stationed at Fort Benning in a student capacity on two occasions: the first time as a second lieutenant in the Infantry Officer Basic Course where he is taught what he needs to know to perform the functions of an infantry platoon leader. The second time as a captain, or junior major, to attend the Infantry Officer Advanced Course in which he learns to function at battalion and brigade level.

The Office of the Director of Instruction is responsible for planning, coordination, supervision, and evaluation of instruction at the School. With this in mind, the Individual Learning Center became a part of this office.

During this presentation I will discuss the following areas:

1. The background of the ILC from 1965 - March 1971.

*Major Stanfield was assisted in developing this paper by Captain Terence J. Kennedy, Officer-in-Charge, Individual Learning Center, US Army Infantry School.

2. Hardware.
3. Software.
4. Operation.
5. Results of the test period.
6. The future.

In 1965, as a part of the continuing program of upgrading training at USAIS, the DDI undertook a project labeled "Classroom 70." The objective of this program was to evaluate forward looking educational innovations with the intended end result of producing a modern training system based on the latest teaching philosophies and instructional technology.

(Slide of USAIS - SRS, CAI, ETV, and ILC)

The classroom would contain such innovative features as a student response teaching system, CAI, ETV, and special purpose classroom such as the ILC and the Combined Arms Tactical Training Simulator. Emphasis would be on moulding these innovations together and placing them into the USAIS. Implementation of the total plan was not possible because money was not available. As money became available, individual steps of the project were undertaken. Student response teaching system, CAI, and ETV were established. The ILC was to come later.

Throughout the period from 1965 to 1970, the thread of continuity and the vision of the learning center was held by the civilian educational advisors at the School. They remained as the primary source of stability while our military personnel were undergoing a period of turbulence in their assignments due to our heavy involvement in Vietnam.

In 1970 the Department of the Army determined that Fort Benning was to be one of the installations to test and evaluate the Modern Volunteer Army concept, now known as VOLAR. With the selection of Fort Benning to serve as one of the four voluntary Army (VOLAR) posts, additional funds were made available and prior plans could now be implemented. The concept of VOLAR covered actions to improve service attractiveness and means of better training and motivating the combat leader of the 1970's.

A small scale version was planned which would permit adequate trial use and subsequent evaluation of the ILC concept. Further, operational and equipment problems would surface and valuable experience would be gained without committing vast amounts of School resources and funds. The new plan submitted called for the establishment of a 25-30 carrel unit, utilizing existing classroom space and costing \$30,000. This project was funded and approved as part of the VOLAR Plan on 20 November 1970.

The first project was to research and develop the physical model of the ILC. This was accomplished by dividing the project into three tasks. The first task, the test and evaluation of educational teaching devices was, initially, a search of the available literature to determine the current state of the art and to develop a recommendation for USAIS use.

A synchronized sound/slide system offered the best potential for ease of operation, in-house production, and flexibility.

(Slides of Synchrotutor and Kodak Ektagraphic)

The evaluation of actual equipment resulted in the selection of the Norelco Synchrotutor and the Kodak Ektagraphic Model "E" slide projector. (Slide of video tape playback) In addition, the use of ETV was integrated to provide an in-house playback capability using video-tape recorders and the reception of ETV programs from the School's ETV Division.

The second task was the design and construction of the student carrels. Since no commercially available carrels met our specifications for size, durability, or collapsability, we developed our own model. (Slide of USAIS carrel) The Third United States Army Training Aids Center then constructed a total of thirty carrels for our use.

(Slide of USAIS Infantry Hall's Classroom 50)

The third task was selection and preparation of the actual site. The facilities had to be adequate for the placement of 30 carrels, centrally located for student use, requiring low preparation costs and providing a suitable atmosphere for study. One of the School's 50-man classrooms was selected. This classroom was repainted, carpeted, rewired, and tested for sound-proofing and lighting. The carrels were placed on the classroom floor and the stage area was used to house a 15-man group study area because although the emphasis is on individual training, some students work better when studying in small groups rather than alone.

The initial software input came from a number of sources:

1. Conversion of S.R.T.S. programs.
2. Conversion of P.I. texts.
3. Purchase of commercial programs.
4. Development by instructional departments.

Falling midway between the hardware and the software were the operational considerations.

Because the ILC was only a test model, we decided to make the

facility available to all resident students, staff and faculty, and military dependents. The priority of use and primary target audience would be the IOAC and IOBC students. Some of our operational decisions were:

1. To centrally store and issue study materials in the ILC so they are readily available to students.
2. The ILC would be open 63 hours per week and honor reservations virtually any other time.
3. Detailed statistics would be kept as to the number and type of students, use of programs, maintenance of equipment, and other operational considerations.
4. Initial staffing was one OIC, one NCOIC, and two monitors.

The time required for the project from concept to ribbon cutting was one hundred days.

The ILC opened its doors on 1 March 1971 as planned. Thirty carrels were operational with a 15-man group study area. The programs available totaled 45 hours (38.5 hours of slide/tape format and 6.5 hours of video tape). Additionally, the more than 500 films from the ETV Division were and still are available on request.

(Slide of overview of USAIS ILC)

On 1 March all 30 carrels contained Norelco Synchronizers, surface mounted and Kodak Ektagraphics slide projectors, wall mounted to permit front viewing with a 3.5 inch lens.

(Slides of TV receivers)

Additionally, four carrels contained 14" RCA color TV monitors linked to the central ETV distribution system. Programs may be played from the ETV Division on any of the seven channels available. Color monitors were purchased in anticipation of the color conversion currently underway. Two other carrels contained 9" CONRAC monitors linked directly into two AMPEX 7100 Helican Scan video tape recorders (1" video dubs are played in these carrels).

(Slide of USAIS ILC group study area)

The 15-man group study area was established to accommodate groups of students desirous of seeing the same program. Both ETV or slide/tape programs may be seen in this area.

Soon after opening the ILC it became apparent that the hardware

specifications should remain somewhat open ended. We sought the following additions:

1. The proposed introduction of the cassette TV instantly appealed to us. This would provide us with a student controlled TV program much like the slide and tape; however, production of this equipment fell behind schedule and we decided to wait until production models became available.

2. The equipment we were using provided total motion programs (TV) or total still life (slide and tape). Research indicated that from both an educational and cost effectiveness standpoint, an integrated motion/still visual presentation would be desirable.

3. Since many programs contain multiple choice questions, some type of device was needed to record the students' answers. The recording of answers gets the student more involved and also aids in validating programs.

On the basis of equipment evaluations we acquired the following:

(Slide of A. B. Dick 8mm Projector)

1. Three A. B. Dick Super 8mm Projectors Model 71. This equipment seemed ideal for our use because of its direct interface with the Norelco Sychrotutor. Students are required to start the projector, but pulses on the magnetic sound track would automatically stop the motion sequence and restart the cassette. The 5-minute capacity film cartridge seems sufficient as most programs would require only 5 - 10 minutes of motion (1 - 2 cassettes) integrated into the slide/tape presentation.

(Slide of QRS Responder)

2. Twenty-three QRS Responders. This unit is simple in construction, durable, and relatively inexpensive. An electric connection to the sychrotutor allows the student to reanswer questions that they answered incorrectly and it automatically restarts the program when the question is answered correctly. The QRS Responder uses an IBM card and may be manually or machine graded to give a read-out of the student's responses.

Students using the ILC facilities are briefed on the use of the equipment and given a set of operating instruction. Even with the relative simplicity of the equipment, maintenance problems have plagued us to a degree.

It has been our experience, and that of the other ILC's with whom we have talked, that the development of quality software is and will

continue to be our area of greatest concern. It has been a slow and painful task for us to substantially increase our program inventory. This is not an indication of an inability to cope with the problem, but rather an indication of the hours of thought and effort that must go into each program before it is added to the ILC inventory.

To give you a feel for the complexity of our production and some of the problems that may arise, let's follow a program through to completion: First, the subject matter specialist gets together with our systems branch programmer and the work begins on the script. After a great deal of interchange (some of it heated) the script is completed and ready to deliver into the hands of the recording studio specialists where it is recorded, edited, and transferred to a cassette. Concurrently, the ideas for the supporting visuals are taken to the TUSA Training Aids Center where professional artists begin their work to turn our ideas into completed artwork. When the artist completes his work, it is sent to the post photographic laboratory for conversion to 35mm slides. The Systems Branch Project Officer then codes the master cassette using the pulse recorder and then reproduces the cassette using the high speed reproducer. He then marries up the slides and coded cassettes, and after a final review places these student ready programs in the ILC. We feel very strongly that it is far better to have a few good programs rather than a lot of programs of marginal quality.

1. Subject Matter Experts.)
2. ISB Programing Experts.)
3. Recording Studio.)
4. TUSA Training Aids Center. (
5. Photo Lab.)
6. Pulse Recorder.)
7. High Speed Reproducer.)

Currently we have programs in four categories. They are:

1. Military.)
2. Enrichment.)
3. Guest Speakers.)
4. Decision Problems.)

In acquiring commercially produced programs, we insist on previewing the material prior to making a purchase.

1. Review Literature and Locate.)
2. Request for Preview.)
3. Evaluate.)
4. Reject/Purchase.)

The objectives of our program are to review difficult teaching points

(remediation), to enhance MOS related skills, and to present civilian educational experiences that are primarily subjects which enrich.

Up to this point, the use of the ILC has been voluntary with the exception of two experiments in instruction requiring mandatory use.

I think you will find the results of our VOLAR test phase interesting. From 1 March to 30 June, a total of more than 3,200 individuals (approximately) have used the facility broken down in the following categories:

	<u>NO.</u>	<u>%</u>	
IOAC	1428	43.5)
IOBC	825	25.1) (SLIDE)
Other	1031	31.4)

Of our four types of programming the relative usage looks like this:

1. Military	48.9%)
2. Enrichment	45.0%)
3. Guest Speaker	3.1%)
4. Decision Problems	3.0%)

A breakdown by target audiences reveals this usage:

1. IOAC students: Mostly enrichment subjects.)
2. IOBC: Mostly military subjects.)
3. Staff and Faculty: Enrichment.)
4. Dependents: Enrichment)

Student comments have been overwhelmingly favorable.

At the current time (FY 72) we are hampered by monetary limitations being funded for one-fourth of our requested budget. One of our most interesting programs in experimentation involves an Artillery Committee mandatory program for the noncommissioned officer classes in adjustment of fire procedures. This program will utilize slide/tape and integrated 8mm motion.

While the initial emphasis in developing Learning Center programs was on quantity, we are now in the process of upgrading the quality of our presentations. We are employing programmed instruction development procedures to include validation of the ILC lessons, and plan to add about 350 hours of programs to the ILC this fiscal year.

Publicity and "selling" the learning center concept is another tremendously important aspect of our work.

Posters such as these are strategically placed throughout the School, post, and have been published in the post newspaper and daily bulletin.

The military training system has long been recognized throughout the educational community as a leader in traditional methods of training. Most recently, the accent is being placed on self-paced instruction which recognizes that students are individuals of varying backgrounds and learning speeds. Sophisticated technological advances such as CAI, CMI, SRTS, and the broad spectrum of equipment which may be interfaced into the ILC concept blend perfectly with this new philosophy. Thus, the vast military training system continues to point the way in developing the optimum in training methodology.

Multimedia Centers in the US Navy

by

Mr. Raymond Stoddard
Director, Education and Training Support Command
Charleston Naval Base, South Carolina

When I was asked by my boss to attend this conference, I was pleased because I needed information. And I remember in our remarks yesterday about the importance of using systems engineering in designing facilities to facilitate learning that we would have many problems. So, I am not here to present any solutions to you but to give you a little background into some of the things that we have done and are considering in the Navy.

For quite some time the Navy has been divided, as most of you know, between the Naval Air Program and the Naval Surface Program. We have in effect two Navies, two different training programs. Recently, they have established a Naval Training Command. The idea here, of course, is to coordinate all Naval training and to create a better use of facilities, money, talent, and ultimately producing a product at less cost. So, up until this recent development, some of us in the Navy didn't know what was going on up in the Navy unless we took the time to visit other activities. My activity was with the Bureau of Naval Personnel which is responsible for surface and subsurface training. They have schools all over the United States--on the East Coast, West Coast, North and South. Each of these schools has program managers. Under this concept each school practically went its own way, did its own thing, made its own initial development, and with coordination at the top we were able to exchange ideas. There are many advantages in this type of operation in developing curricula and methodology. There are a few disadvantages, of course, and that is, of course, some of us keep inventing the wheel. Of course, this is the main concern for attempting to coordinate what we are doing.

Admiral Bergner, this year, put out a paper to all of his program managers and the top honchos on his staff asking them to present position papers to him on how they could revise their training requirements by using systems engineering. The Navy had developed something we call Personnel Qualification Standards as well as our requirements for advancement and rate. These Personnel Qualification Standards were designed primarily for the shipboard environment. What would any of you, for example, have to know about a particular type of ship. You may be proficient in a specific area

but when you go to another ship, you have different equipment, different systems to operate. So, PQS was designed to bring the individual up to speed as the circumstances of that particular ship were concerned. This opened up a whole new ball game as far as learning centers are concerned. The Navy does have a distinct problem. Much of our training must be done at sea--must be done in a shipboard environment--but what we have found out is that the learning center, or resource center, or information center, or whatever name you want to put on it, this concept makes a great deal of sense and Admiral Bergner was very concerned about the lock-step methodology still prevalent in many of our formal schools and even in shipboard training programs. We set up certain specific times to accomplish certain specific tasks regardless of the requirements, you might say, of shipboard evolutions or the complexity of the subject matter. So, there is a great deal of thought given to change today.

I didn't bring any slides with me because I was trying to look at this program from the overall Navy picture when I came here. We have so many different problems that I hoped that in being able to communicate with you I would pick up some ideas that I could take back that we could use. Within the Navy we have tried just about all the things you gentlemen have tried. We've used the same type of equipment that is in use now at the Infantry School in their learning resource center. We've used educational television. We've used dial access limitedly. We are very interested in computer instruction and have spent a great deal of money on this. But what are we going to put in these resource centers and what type of resource centers do we really want?

First of all, it is obvious that if we have a formal school with a known training requirement, we can design our resource centers to fit these needs. On the voluntary aspect that was mentioned this morning we have one experiment going on in the Navy right now on a very limited scale aboard one ship and at one Naval Air Station. It's a very simple experiment. In fact, you gentlemen might wonder why in the world they are doing this or what's so great about this idea, but they have placed some film readers in the base library and in the ship library and they have brought some films into the library. The attempt here was to find out whether or not people would voluntarily look at audio visual material. They tried two different things so far: one thing was of direct interest to the individual as far as his advancement is concerned, the other--the enrichment idea.

In the few months this program has been operating the demand for it has practically skyrocketed. The 99% favorable attitude that the Infantry School uses in the resource center has been expressed in these little laboratories. The users want more of this. They want

more material, more media. Now, I don't know what will be the final result. Will we be able to afford to equip these libraries with additional projectors, for example, and films? Films are expensive even though some of them are the single concept super 8 loops-- these did not turn out to be very popular in these voluntary resource centers. But the sound films did. The other thing we are attempting to do is establish, where we have major bases, these educational and training support centers. This idea is just getting off the ground. What we have done is combined the whole training aids crowd, educational services, and the Navy library program. We have had a shotgun wedding, perhaps you would call it, but the idea is for them to all work together and for them all to meet the needs of our people in the Navy. Eventually, we hope that through the facilities on our major bases and the support centers themselves that we will be able to develop resource centers for our people to use.

When it comes to our schools--I would like to get back to this again-- our schools have used just about everything each one of you may have used in your command. We have run into the problems of hardware and into this problem of software. And, as you know, we are going into the super 8 business, perhaps not as rapidly as we would like, but we are committed. I think the entire DOD is now committed to the super 8 and the United States Navy most assuredly is. And because of this commitment, we have decided to hold back on some of the hardware configurations of our learning resource centers. What type of equipment will we use? For example, Fleet Ballistic Missile Submarine Program has developed a Personnel Information Program, as they call it. The program started several years ago with a \$500,000 grant and the main idea was to put media and materials in the hands of the individual sailor when he was on patrol, at his convenience. So, they bought cassette tape recorders, micro film readers, and then "Technicolor" optical/sound projectors, and film strip units. The Naval Reserve in the meantime had come up with a new training concept for Navy Reserve Petty Officers called Formal Individualized Training System. This system was designed to try to give the petty officer--who may be in Iowa and the ship he would serve on would be on a beach in California--an opportunity to keep updated on some of the knowledge areas that he should be familiar with. So, this project got started using the A. B. Dick Super 8mm Cassette Projector. Bell and Howell came out with an idea that one of our Navy schools became interested in and we only purchased a few units of that particular machine that they put out.

Now, within the Navy, we have decided to hold off on further procurement of super 8mm until we have a standardized unit that will be compatible as most of you have probably read in the DOD findings. We are not going to be investing a lot of money on hardware until we decide that we can get non-proprietary configurations. We have had some success and some failures in our efforts in developing

learning centers. So, my intent, as I told you earlier, was to come here and perhaps gain some experience that I could take back. I have learned a great deal since I have been here and from what I have seen I could not have told you anything you don't already know as far as the state of the art is concerned, as we are using it. I do hope that this meeting will be just a beginning effort for us to work together and to develop lines of communication so that we can save our money and develop procedures that will keep us from re-inventing the wheel.

Last year at the Naval Academy there was an educational technology conference and one of the recommendations of that conference was that they create an organization of military educators. I don't know whatever happened to that idea. They said that perhaps this group could meet at the next Armed Forces' section meeting of the AECT conference. But we do need to get together to open lines of communication to make our dollars go further and to utilize what some of you have already done.

That concludes my remarks and I am looking forward to an opportunity to benefit from some of the recommendations that you have.

USAF Approach to the Learning Center

by

Dr. Edgar Smith
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Introduction:

There has been no one Air Force approach to the learning centers. Over a period of years, there has been a continuing, and somewhat coordinated, series of projects. Luckily, our flow of information is adequate to encourage each of us to learn from the others.

My coverage here today will be aimed at summarizing briefly a few of these efforts that have been particularly influential in shaping our thinking. It is by no means a complete review nor are the items mentioned necessarily the most important. They are just the ones that appeared to be most germane to this meeting.

LACKLAND - CARBINE

(Slides of the Lackland Carbine Program)

In the 1961-63 time frame, several projects were underway that have been quite influential on the Air Force program. One was the carbine study at Lackland. In it we used a lot of ideas that were considered to be rather new fangled then. As I recall, one was a version of what later became known as a programmed text. Another was an audio-visual presentation using the Revere sound-slide system. This system, by the way, dropped out of the market. It has recently been revised and reintroduced under the name of Sound-on-Slide and uses the 3M label rather than older Revere. As a control group, we decided to use a full blown control with no instruction at all. We just put the airmen in a room with the carbines and told them to take them apart and put them back together. From this we learned several things. First, the audio-visual device gave us some trouble and the training aids shops generated the slides in a very slow and expensive way. The total expense for the audio-visual then, as now, was unnecessarily high in terms of both money and manpower. The second thing we learned, and this is one lesson I try to keep in mind, was that the control group learned as well as the experimental group and even reached the required level of proficiency faster than either the programmed text, the audio-visual group, or the instructor trained groups. I think we should keep in mind

that often the most efficient way to train is to get out of the way and let the student learn by himself.

(Slide of B-52 - Photo Mockup)

Another study was initiated during this time span by Modrich and continued by Don Meyer related to fidelity of training simulators. Their experience indicated that with sophisticated systems often the fidelity can be carried too far and tend to inhibit performance. The real bomb-nav system of a B-52 is so elaborate that the students were reluctant to touch it. Substituting photo mock-ups during parts of their training seemed to be desirable.

A third study started during this time was the presentation of electronics fundamentals at Keesler using the Mark I Autotutor with its branching capability. (Slide of Autotutor) The biggest thing this proved was that writing good branching programs was a very difficult job. Incidentally, that device, the Autotutor Mark I, held 10,000 pages of material and could go from any one page to any other page directly. In other words, the author could branch to any of the 10,000 places. The device also included movies. In fact, the demonstration film that came with the device showed golf swings in motion with appropriate still frames to ask questions. Frankly, no one has ever learned how to utilize either effectively yet. Random access sounds good, but how do you use it? Incorporating motion in a slide presentation sounds good, but can you recall times when it has been used effectively (except for football coaching)?

WRIGHT-PATTERSON

(A series of slides illustrating the Wright-Patterson efforts follows.)

There was a study done at Wright-Pat a number of years ago that was almost a classic in this area but it has received virtually no attention. It was classic both in the problem and the results. The problem was this: we had a number of electronic engineers who were good competent men but who were limited because they did not understand solid state materials. You have to remember that the half life of an engineer is only about 7 years - translated that means that half of the knowledge an electrical engineer needs has been developed within the past seven years. No matter how good of a student he might have been, an engineer who graduates even from the best of colleges just isn't trained in those areas developed after his graduation. The need for continuing education in such areas is great. So the problem was to get these men, all of whom were working as engineers or technicians, and up-date their training without a major personal and financial upheaval. We used this as a vehicle to compare programmed instruction, automated instruction, and conventional lecture with training aids. The outcome was also

classical in that the really essential data was not anticipated and as a result not recorded for publication. The publication indicated that all three techniques were acceptable but, as I recall, suggested that the automated was somewhat more effective than the other two. What it didn't report was the way the students became involved in the programs. The course lasted three or four weeks with one group in the mornings three days a week and another group in the afternoons. Naturally the lecture group was scheduled in length but the other two groups were both self-paced except that they were told that they were expected to stay at least two hours each session. After the two hours were up, they could leave anytime they came to the end of a block of instruction. In some way, after the two hours were up each day, everyone in the programmed instruction group came to the end of a block within 30 seconds. Their room was completely empty by one (1) minute after eleven. In the automated apprenticeship room they continued to work. We actually would have to ask a few of them to leave at 1230 so that the afternoon group could have the equipment. If they were out on a flight and missed a session, they would make it up on their free time (that was also my free time so I remember it well). Similarly, the programmed instruction room was interrupted by the slightest distraction but nothing distracted the automated group. The automated session was conducted in my lab. It soon became obvious that we could continue with business as usual without disrupting the students. There would be six people sitting at their automated work station and my technicians and I would be moving about talking, holding consultations, making audio tapes and slides, without interrupting. We even made a movie of them and took these slides while they were studying. As I recall, a couple of them glanced up when the flash went off but that was all. Much of this was due to the material. It was prepared by one of the men from RCA's Cherry Hill group and he was good. Sorry, I can't recall his name. It was Glen something. But I do recall that he was good. At the end of the first hour, each student had actually built a little radio and was receiving the local station. They turned heat lamps on diodes and measured changes in conductivity and the whole bit. So this brings up three classical points. First, learning centers are particularly appropriate when there is a clearly defined need for them. Second, the students did relate well to automated techniques. Third, and most important, this demonstrated that learning centers can be distributed and made available at the duty station rather than requiring all students to go to a technical school for such continuing training. As I will indicate later, we also feel that for some situations this can be done for initial training also. But it is a particularly useful technique for continuing training. And with an all volunteer force, we are going to need a lot of it.

AMARILLO

In the 63-65 time period, some work was being done at Amarillo AFB in the panhandle of Texas. There it was shown quite conclusively that single concept films could be used effectively. Bush also demonstrated that it is possible to use audio-visual devices to assist students with specific reading problems. (Slide Showing Comparative Data) The data in this slide reflects her findings. Without going into detail, the students shown in red are students with specific reading disabilities. As you will note on the right hand side of the chart, in two situations, they actually did better than students who could read well. This is the only bit of research that I'm familiar with in which the students with lower reading scores actually learned the fastest. In this situation, the poor readers did do well. Remember, they were students with limited reading ability, not with limited intellectual ability. This suggested that a learning center that allowed students to learn in terms of his unique strength might be efficient and effective.

LAUGHLIN AFB, Texas

(Series of Slides on the Laughlin Activities Follows)

Probably the single center that has produced the most impact per dollar was the one at Laughlin AFB, Del Rio, Texas. It proved that the classroom instructor can make an impact. Two captains who were pilot instructors wanted to beef up their briefing and debriefing sessions with students. They in some way got in contact with Milt Wood who was then at Wright-Patterson. The instructors came up on a cross country training flight and we worked out some of the details. One I remember involved the focal length of lens to be used during filming. This is what happens to a runway when you change lenses. This is a T-41 runway through a normal lens. They wanted a wider angle to show more terrain. When you include it with a wide angle lens, notice what happens to the apparent length of the runway. Even I could bring a plane in on one this long. The point is, focal lengths change perspective and there is no point fouling up apparent length if you don't have to. We were able to bread board this within my lab and get a fairly good feed for how to do it. Then we were able to lend them the major equipment to get started and show them a little about how to do it. Since they didn't know they couldn't do it, they just went ahead and did it. Milt managed to buy a few Fairchilds out of our funds, and Laughlin fixed up a room for them. The base had a very inventive graphics man who came up with some very inexpensive animation. The things I want to stress on this are: 1st: a classroom instructor can get things going. When these instructors left, interest dropped and it wasn't possible to get sustaining backing. But a number of high level people saw it and liked it. It took a couple of years to recycle it through, but I

really believe that we would have had a much more difficult time getting Williams or Moody or Keesler flight centers without this prototype. In many ways there are advantages to starting, letting it die out, and starting over. You get a fresh start based on experience instead of being saddled with initial guesses. 2nd: It did exist on a flight line, not in an academic center. It was to supplement performance, not teach theory. The center was taken to the need, not the students uprooted and exported to a school. 3rd: the material was locally prepared and was effective largely because they were local. There is a place of standard materials developed on a service wide basis, but there is also a place for local material.

KEESLER

(Series of Slides on the Keesler Facility Follow)

Building on such experimentation, the Air Force started using learning centers as such about two years ago.

One of our first full blown learning centers was the one specifically designed for Vietnamese students that was instituted at Keesler. The President had indicated that he wanted to "Vietnamize" the SEA situation. Limited funds and facilities were made available to design a learning center to facilitate their training. However, trained audio-visual personnel were not available. By utilizing 1/2" video equipment as a writing tool, the instructor pilots were able to implement the program in an exceptionally short period of time. This demonstrated the efficiency of video as a creative tool while developing training packages. These were then translated into pre-narrated slide presentations and movies by other base personnel. We learned several things here. One, the concept of "containerizing" training segments was demonstrated. You can package training in such a way that it can be transported to another locale and presented there with a minimum of original cadre. It also demonstrated the desirability of developing individual segments in a format suitable for group presentations. This allows for the utilization of the segments in group situations when the weather is too bad to fly. This automatically acquaints the instructors with the material so that they make effective use of it as a remedial or refresher tool. It also gets all members of the staff participating in your program. But, most important, it demonstrated the amazing power of portable video equipment during the initial development of sequences especially in its power to let technically competent personnel develop sequences with only minimal inhibition by their lack of audio-visual training.

WILLIAMS

(Series of Slides on Williams AFB Follows)

Photo mock-ups are a good tool. They have a place in the old concept of "mental set" that psychologists used to pay a lot of attention to. I don't know who got the idea originally but Milt Wood is the one who implemented it and made it go. Seen in this slide are the learning carrels for the T-37 at Williams. They resemble the cockpit enough to facilitate transfer and create a positive mental set. With a minimum of moving parts they did not increase costs prohibitively. Some of the carrels do have a few moving parts, but these are just procedural trainers and do not interact with the training sequence. A by-product learned here at Williams was the utilization of dial access audio. The experience here convinced me at least that rapid reproduction of cassettes has major advantages over dial access. You must remember that in dial access when a student calls up program 1, then every other student wanting program 1 has to join him in progress. Additionally, any student wanting program 2, 3, or 4 has to pick it up where the tape is rather than at the beginning. This plus the lack of synchronized visuals makes it a very limited system from my point of view.

Another feature of the Williams system that impresses me very much is its location. The centers are deliberately and effectively located directly on the flight line. The student does not leave the flying atmosphere to enter the "academic area." The two blend together. This is perhaps even more noticeable here on the T-38 center. Milt, with his usual unique touch, has created a learning situation that encourages learning at minimal cost. I guess the success of most learning centers will ultimately reduce down to whether or not they have the personal touch of a talent such as Milt's. That talent is one ingredient we just can't reduce to a computer program.

SHEPPARD MEDICAL SERVICES SCHOOL

(Series of Slides of Learning Center Activities at Sheppard AFB Follows)

The physician assistant course at Sheppard has a learning center that again reflected a unique approach. When the course was conceived, it was decided that a learning center would be required. The course material was initially developed with this in mind. It is unique in many ways. It is one of the few centers that was designed from a full systems approach. The course material was written specifically for the center. The media and carrels were selected with inputs by both the instructors and the graphic personnel. The graphic department was expanded to make it possible to create the required images. The photo production capability was expanded to meet the need. I don't know if it worked out like it was designed, but it did demonstrate that a full systems approach is needed before instituting a learning center. It doesn't do any good at all to direct responsibility to some poor soul to start a center if you don't at the

same time give him the time, the personnel, the support, the equipment, and the space. The best audio-visual presentation in the world doesn't teach worth a darn until the slides are developed and the tape narrated. And it does help to have someone to do a little maintenance.

AUTOMATED APPRENTICESHIP

(Series of Slides on Air Security Police Training Follows)

There are two additional projects that are relevant to learning centers. One is our Automated Apprenticeship project for Security Police. Here we are making an attempt to put two full courses on audio-visual devices. A small device employing 16mm filmstrip and 1/4" magnetic tape in one combination cartridge is being used. All of the course material for both traffic police and missile security has been put on this device in an effort to reduce the amount of reading required. The project has one interesting condition. It is the correspondence course rather than the technical school course that is involved. As a result, the object is to find a system that is economical enough, light enough, and reliable enough to work in the field training men one at a time when they are assigned directly to their duty station without going through a technical course. If this is successful, and everything looks good at this time with all of the course material written and in use in the field, then we have an additional tool for our learning centers. Some of the material can be sent to the man instead of requiring him to come to the school. Especially in terms of the all volunteer army, we feel that this will be important.

COMPTROLLER

(Series of Slides on Learning Center Activities for Comptroller Training Follows)

The other study in this pair was done in the Comptroller's school. Here the problem was, what would happen if the course material were presented on microfilm rather than from a printed manual? Several things came up that are relevant to learning centers. For one thing, if you have a class of twelve students, how many microfilm readers do you need? If you feel that you will need one for each student, you are wrong. For twelve students you need at least twenty-seven readers. Each student needs one in class. But he also needs one for his homework. If he is married and lives off base, transportation can be a problem. If he lives in the barracks, storage can be a problem. You will also need at least two in the remedial room and the instructor needs one. Not counting spares or replacements, that takes twenty-seven readers for a class of twelve. And that is with microfilm that is easy to handle. What

are you going to do in a learning center where the student learns from a computer controlled terminal? How does he review his material? How does he make notes in the margin to indicate questions he wants to raise in class? How does his instructor know what remedial help he needs? And don't try to pass the buck on to the computer and its program.

ADVANCED INSTRUCTIONAL SYSTEM (AIDS)

(Series of Slides on the Advanced Instructional System Follows)

All of these culminate in the Advanced Instructional System being developed at Lowry AFB in Denver. At present this is the Air Force's major investigation into the practicality of putting a full Technical Training Center into a learning center configuration with major management functions being completed via computer. That gets a little complex, so let me read a description of it written by Duncan Hanson. The primary goal of AIS is the demonstration that a computer-based multi-media training system can provide significant cost-effective improvements in the operation of three training courses within ATC at Lowry Air Force Base. The management of the project is under the direction of the Human Resources Laboratory of the Air Force Systems Command. It will be a joint endeavor with and located on a Technical Training Center of Air Training Command. It will provide day-to-day training for some 2,000 students enrolled in three technical training courses. At the present time, we have a contract with Florida State University who is helping develop the overall systems specification. We have a contract with Hughes Aircraft for the design and specification of carrels and software generation systems. The three courses involved were selected to represent as broad a sample as possible and as a result are as different as any three courses can be. The Inventory Management course is primarily an administrative paper and computer oriented course. Original development of this course is being done by SDC of Santa Monica, California. The Precision Measuring Equipment course is the epitome of technical courses. It involves considerable hands-on training and includes the training of foreign nationals. Initial work in this is being done by McDonnell Douglas. The Weapons Mechanic course involves gross motoric activities and includes team training. The team of four has to load a real 500 pound bomb on an F-4 using flight line tech orders and procedures. Strategies for teaching this course are being developed by Applied Sciences Associates. A sixth contract that is directed at developing appropriate instructional strategies is presently being negotiated. It is too early to give any indication of the success of this venture, but we are giving it a real good try. I feel that we have the most experienced and most competent staff of systems engineers, instructional technicians, computer personnel, and media specialists that any learning center has been given. We have been involved in many past

programs and hopefully have learned from them. Our biggest advantage is in the blending of diverse talents. We do have personnel experienced in many of the required areas. We are not overly enamored with any one technique. As a result, I really believe we can make a go of it.

Group Activity Related to Learning Centers

Chairman: Mr. Richard S. Kneisel, Education Advisor,
United States Army Infantry School

Following the presentations by the Army, Navy, and Air Force representatives, on their experiences and problems with learning centers/multimedia centers, the workshop participants were divided into three groups with each group having one of the presenters as a specific resource person. Dr. Leslie J. Briggs, Florida State University, moved from group to group to lend additional depth and experience to the discussions.

While the three individual group discussions were taking place, each group was given a chance to view and engage in learning center experience with a carrel from the US Army Infantry School's Individual Learning Center which had been set up in the room. Each group of about 15 persons rotated to the learning center carrel and was briefed by Captain Terence J. Kennedy, the Officer in Charge of the US Army Infantry School's Individual Learning Center, on aspects of the carrel and how the Infantry School uses its Learning Center.

After an hour of group activity and discussion, each group reported back its findings and main points resulting from the group interaction. The following are the reports of the group findings by each of the resource persons.

GROUP I - Mr. Ray Stoddard (Charleston Naval Base, Charleston, South Carolina)

We ran into a couple of problems in trying to determine just what a learning center was. We were thinking in terms of a learning center based upon two of the excellent visual presentations this morning. Some of the gentlemen in our group felt that they did not have an immediate requirement for learning centers per se because they had ongoing, formal school programs and some of the techniques used in the learning centers were actually utilized in some of their classrooms. We also discussed the cost of the equipment, how much money can we spend for this, and how sophisticated must we become to motivate the student. Some questions were raised. Can the student be motivated in an atmosphere that is not very aesthetic? Some of the comments were "yes" the students can be motivated if the materials are designed to motivate him and he has some interest.

We also discussed the problems of preparation of materials. We noticed that in looking at the carrel brought here by the Infantry School, and seeing the slides, that the slides we saw were not

prepared by the official United States Army Audio Visual shop but by a friend of one of the instructors. It was our consensus that those slides were as good as any we have seen and that you don't necessarily need formalized slides to do an effective job. We are still slightly confused about which way to go because I think possibly that in any group like this we have apples and oranges trying to be grapefruit. But we did attempt to exchange some ideas and it was a question, I think, of trying to figure out if some of these things would fit.

I know that one question that was asked by one participant in our group was relative to the do-it-yourself M16 course used by the Air Force so effectively. Is it still in operation? (NOTE: Dr. Edgar Smith indicated that the system was not in use now but some thought was being given to testing it out again.)

My group also felt strongly about the applicability of the learning center to the college level activity, particularly the graduate level instruction to the officer courses at the Advanced Course level of the Army which in the Air Force is I think the Squadron Officer School. Because we are running into a problem in the present schools in getting qualified instructors on the Army posts to give graduate level work, the learning center has possibilities. After having heard a presentation yesterday in another workshop talk on television's accredited courses, there might be some possibility for exploiting this approach in the learning center--in other words, getting the courses put on cassette and in the proper format for one of the multimedia carrels and letting the Advanced Course student take this rather than from a live instructor because I think our problems with getting live instructors are common. Our sources are drying up all over and we don't know how we are going to carry on the electives program. We recognize that there would be a problem of standardization and there would be a big problem of accreditation. We think these might be solved at DOD level or somewhere up on the all-service sort of arrangement. One other comment. This might be a difficult one in the introduction of new equipment in the field and then the application of multimedia programs in unit training level. Introducing a piece of new equipment really is a part of the training that a learning center might afford as an approach to this problem.

GROUP II - Major Howard S. Stanfield (US Army Infantry School,
Fort Benning, Georgia)

We started our discussion by addressing the cost of the USAIS Learning Center and what that \$30,000 funding was for. I think that after all was said and done, we realized that that \$30,000 bought a lot more than \$30,000 worth of equipment. Because of the way we

are set up with TUSA Training Aids Center, they constructed the carrels and did the site preparation. These people did the work and are already salaried so our costs were for materials. Labor costs, except for overtime to meet deadlines, were not adjusted against our funds. If you were to build a carrel for your son because you think he would benefit from a multimedia approach to learning and you wanted to build it exactly like we did, I'm sure that it would cost you more than \$106 (our cost) at the local cabinet shop.

Next, we talked about the problems that we have encountered with the Norelco Synchrotutor. We've encountered every failure imaginable and will provide detailed information on request. We're being helped out by the Naval Training Devices Center who recommended the Norelco to us. They are attempting to rectify our problem by applying pressure to the manufacturer. That brought up the next problem: If the Norelco is so bad, why did you buy it? Our biggest problem is that we did not have a well defined Systems Approach to establishing the Learning Center but you must understand our problem in its historical context; the way we were funded and when we were funded. To get the Learning Center at all we had to go ahead and charge down the road and build it. We all agree that this may not be the best way to do it but we've got a Learning Center and it is operational and successful. Our last subject was the conversion of other forms of instruction to the ILC format. Specifically, the question of programmed texts came up. We have found it fairly easy to convert PI texts to the slide and tape format. We also discussed saving money by using a 35mm camera and Kodak film and other expedient techniques to avoid long lead times on art work.

**GROUP III - Dr. Edgar Smith (USAF Human Factors Laboratory,
Lowry AFB, Colorado)**

The general feeling in our group was toward equipment. One of the main things was: Why wait for the standardization of a super 8mm projector since this will never happen? Use what's available to get the program going. In other words, why hold off two years waiting for that little black box to come out? Software to go with the equipment was the predominant thing. The group felt that to produce software took some special considerations. But once it's produced, it can be converted to any format whether it is video, audio, etc. With regard to standardization we probably will not see that anyway; and, if we ever do, it will probably be to the detriment of on-going programs so use what you have now. If you buy something new and you don't use it, you're going to get rid of it anyway. And, if you buy it and use it, it's going to be worn out by the time the black box gets here.

One of the points we noticed was that there was a commonality, early

early in the session, in the use of the learning center type of technique. They appeared to be picking a group of people; such as, the Republic of Vietnam people who have been through a common based experience--for example, the language learning center. They had this type of thing at Lackland, then they took some of them into Keesler with the Air Force fixed wing, etc. They progressed to a degree and it was very well utilized there within the Air Force side of the organization. They also went into the rotary wing portion at Fort Wolters and from Fort Wolters went into the same type of learning center capability at Fort Rucker, Alabama; and also over at the Stewart complex they have one. There appears to be an acceptance of this group as a whole for this type of media is very healthy to say the least. They utilized it. Of course, they require it because standardized instruction is going to them in their language as well so that they can monitor. It appears that we can start our children at home on the TV sets which (and I don't think there is anyone here who has children at home who don't watch TV)--but the commonality in this type of equipment is in the rote pattern, in the children on up through the schools, all the way through. The commonality of the group was the point we took off from.

Our group also had a lot of discussion on hard skills versus soft skills. The hard skills are what we have reduced ourselves to at the present time, not only in the learning centers and CAI's but everything else that goes throughout. But one of the areas we have to get to is the idea of the soft skills. We do seem to be reduced in our behavior objectives so that we can go ahead and carry out the continuity of the structure not only for the masses but for most of the people who initiate the work with the masses. For example, if you take a car into a repair garage, we have all kinds of training programs for the individual who will do the maintenance on it; the individual who is doing the diagnosis is probably picked for instruction way prior to that time. And, as far as his managerial capability, we haven't touched on the manager of the system, who may be the most important person to be trained.

One quick one to tie in what was brought up in this group: mention was made, "Should you tie in computer assisted instruction into a learning center?" And, in many instances, this is the case. It was brought out that perhaps the use of CAI needs to be looked at carefully because what you are doing is tying up an expensive piece of equipment that might be better used--not as a page turner but as a manager of instruction. Rather than having the terminals and the whole computer configuration tied in with a thing called a learning center, it would be better to look at whether it is actually going to be as usable as the programmed instruction book or the sound/tape coordinated simple system. Don't waste a computer when something else will do.

Following the group reports Mr. Kneisel, the Chairman, called on Dr. Briggs, the overall Methods and Media Resource Consultant, to give some of his ideas as he moved from group to group.

Dr. Leslie J. Briggs (Florida State University)

My main interest here is the overall strategies of planning and trying to develop what you've got to say. I realize most of you are either military combat men and secondly training men, but I was interested, without breaking in, in the theoretical kind of sessions like yesterday afternoon when the group addressed themselves to what we might call the mysteries of different problems that arise when one tries to do them. And those are just as necessary to address as the overall strategies.

I guess my general observations have been evolving over twenty years' experience and I guess the only real advantage I can see of getting old is that you begin to appreciate what other people are doing and what other people are trying to do. My total experience--my military, industrial, and educational--has led me to see this: that even though you have these problems we discussed - the administrative, logistics, and cost problems that interfere with the best effectiveness of what you are doing in instructional technology--I think that one thing I am in a better position to see than you are, the only conclusion I have reached, everything considered, is that I think that advances in instructional technology over the last thirty years have tended to start with the military training center. Once they've started and gotten some exposure to realism and some evaluation, the next kind of establishment to pick them up is the industrial training establishment. So it seems to me that although you are acutely aware of your problems and no doubt seek refined techniques, refined management systems, refined theories, nevertheless, it is my humble opinion that advances in instructional technology do begin in the military services. They next get used in industrial training, then they go into perhaps an elementary school of education, then to secondary schools, and last if ever at the universities and graduate schools.

So, my present role, having been through the military and industrial phase, is to try to make the graduate school do an about face so it will become the training ground to help teachers and/or military people get the advantage of a systematic way of what the military services have often started, to be followed up by industry and education.

WORKSHOP SESSION NO. 4
COST EFFECTIVENESS AND PROBLEMS OF
COMPARATIVE EFFECTIVENESS OF
METHODS AND MEDIA

V-169

Cost Effectiveness - Methods and Media Effectiveness

by

**Dr. Edgar Smith
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Lowry AFB, Colorado**

Someone referred to Dr. Briggs as being the horses head. My coming at the end of this workshop puts me, therefore, in an awkward position. Regardless of my position, I want to go over some of the things that you have to worry about in considering cost effectiveness. To do that I first believe I have to give a little background.

To begin with there are many types of training--not just a single one, as I know you are well aware of. As a point of departure and refresher, I would like to run down some of those types of training. Probably the basic type is the old-fashioned lecture and usually in a lecture you're talking about theory. One thing that intrigues me about some lectures is that they are brought in to ad lib and give the current and present state of thinking. For example, my thinking changes from day to day. I feel a lecture today is appropriate but the chairman's desire for a copy of my remarks two weeks in advance is a little bit inconsistent.

The next level--not necessarily up or down--is the written one. And usually the written thing tends to be more practical--usually one speaks about theory and writes about something practical.

The next level is when you write and use an illustration.

The fourth type of training is when it is pictorial; such as, sound, slide, movie, video, EVR, whatever.

The fifth type is laboratory, perhaps where you are working with general material.

The sixth type is a software simulator and the seventh type would be a hard simulator where only a single thing is being simulated.

The eighth type is the job performance where the guy actually goes on the job.

Now the reason I want to run through those is that most times when you talk about cost effectiveness you want to compare teaching techniques from two of those styles. And there's no way of doing it.

That's a normative decision you've got to make based only on your own value system. You cannot measure effectiveness between them. It's a judgment that you as a professional have to make.

I also want to point out that of those eight steps of instruction only the last one has any value as far as production goes. The first are all complete waste of time except for the imparting of instruction. So the object of it is (to me at least) to get as much of it in the job performance areas as you possibly can if you are aiming at efficient, effective training.

The second point I want to bring up is that you cannot do cost effectiveness in a training situation. Trying to compare media within the same training situation is like trying to decide when you have a good steak dinner whether the steak is better or the potatoes. I tend to like both the potato and a steak. In a training situation you've got to have many media and it's hard to differentiate out which is a good one.

Now the reason I went over those is: on cost effectiveness, if you are thinking about replacing any one style, then you've got a normative judgment, a value judgment, and you're going to have to make it on your own experience. You cannot do cost effectiveness studies between those types. You cannot demonstrate that a hard simulator is more effective, more cost effective, than a lecture. You've just got two things and you cannot compare them directly. I know that we are given the assignment to do it, we wish we could do it, but so far as I know no one has come up with a way to do any more than make a value judgment. Trying to prove that your learning carrels are more cost effective than a lecture is pretty much of a lost cause. You're working on cost only. What you can do is hold your costs the same and try to show better effectiveness.

Now another place you have a great deal of trouble showing cost effectiveness changes is within a training situation where you have more than one type of media used. And the reason for it is you don't use media in that big of a chunk. In order to prove that sound/slide is more effective than motion picture, I've got to have twelve consecutive hours that can be taught in either way. In the first place, we don't make twelve-hour movies. In the second place, the subject matter is not equally suitable to both of them. So, you end up doing a cost effectiveness and media study between motion and stills and subject matter itself determines the results. Compounding that is the fact that media by and large is most effective for about its first thirty seconds and you cannot make a noticeable major change in a 30-second period. I think, again, if Captain Amos will excuse me, I would like to compliment him on the way he was able to go from lecture to slides, to lecture, to movies, and keep it in the short 30-45 second bursts which is as far as we know the most effective

way to go. But that statement "most effective" is a moral judgment on my part and I cannot cost effectively prove it because I can't show that you learn more or less by having motion in there or taking it out. The chunks to be investigated are too small.

Now some people say why don't you make a bigger chunk. I'd like to run through one example why you can't make it in a bigger chunk. The point came up after the Watts trouble. McNamara asked us to see what we could do working with the deprived groups and gave us some money to do it. He created a thing you might recall--100,000. They asked us what we would like to train and we selected our Security Forces. So, two years ago I started a project to prove that working with students who do not read so well I can take this career field and teach it to a bunch of 100,000 troops, working in a correspondence course. So, those are my three major parameters: I've got a single course working with project 100,000 type people and working on a correspondence course. I started in January 1970. The career field has been subdivided into two completely different career fields now. Missiles have been split out. So I've now got two career fields instead of one and what that does to experimental design is beautiful. We dropped out major missile systems and added others in. So, my internal objectives are completely changed. We no longer have 100,000 troops and that course is no longer taught in correspondence, so all three parameters I started out to investigate eighteen months ago are no longer effective. And, as far as I know of, virtually every decent study started has run into the same luck. We do not teach the same material to the same type of men over a long enough period. How can I run a study in August and compare the results of the August population with the November population? Because by and large my August population has about five I. Q. points head advantage over my November's. And that's the kind of stuff we are continuing to run into.

On a presentation, rather than try to find the one type of pabulum or the one K-ration you are going to shove down everyone's throat in all ways, I think we would be much better off to approach it as though we were designing a meal in which we are trying to put some steak and some potatoes and some peas and some dessert, and some drinks afterwards, and have a mixed variety rather than looking for the media to present something. Why talk about "Are we going to use CAI, or video, or slides?" Why can't we use all of them and have all of them available?

Another analogy that might be better would be to talk about your media as though it is a tool box. Which is the most cost effective tool in your tool box--your pair of pliers or your screwdriver? And if the screwdriver is, which size screwdriver? Personally, I like to have a big screwdriver for big screws and a little screwdriver for little screws. My Supply people don't like me to have two

screwdrivers. But we do need the vitamins and minerals in our menu that we put in the carrels. And if you take 50% of your time to motivate the students so that they learn in the carrel, don't think it's cost ineffective to put that kind of material in. Motivation of material might be very cost effectiveness but you might have a very difficult time showing it taught any internal objective. I imagine most of the services have done the same as we did. We went through and knocked out all the "nice to know" stuff. What we are finally beginning to realize now is that most of the "nice to know" stuff was very nice to know and helped the total learning situation.

Now, how can you do a cost effectiveness study--can get cost effectiveness data? There are two major ways. One is within the mechanics of making any one presentation. You can make slides for \$35. You can make other slides for 35¢. You can put them on the screen and your people are going to learn about the same type of thing about the same manner. If anything, a little bit more. If you think a well-lettered, impressive slide is always necessary on the screen, take a piece of text out of your text manual and print those letters in five different colors and try to read it. If you're only trying to convey material on the screen, then the black and whites we've been using here today are just as effective. They cost about 35¢ apiece to do. I don't know how the rest of you are doing it but we can give our Sergeant up to 120 images in the morning. He reproduces them on the microfilm and runs through the ozalid machine. He has them back up on the screen for us in a matter of an hour and a half. They do just as well as the much more expensive hand lettering which take a great deal of time. The thing I like about it is that means that the guy that gives them to me has to sign down at the bottom that there's no spelling errors on them and that they are saying what he wants them to say. Where, if I do the art work, then it's up to me to make sure they are spelled right and say what they want.

So, you can make changes within production techniques. You can produce an 8mm. If you only want one copy, you can produce an 8mm for about 8% to 9% of what the 16mm costs you. You can produce in video very effectively and cheaply. Your training time on video is phenomenally small as compared with the 16mm film. So you can make changes within a single type of media.

An example of what I am talking about is reflected on a briefing that one of our Captains had to give for General Miller out of the Pentagon. The Captain has gone around interviewing Vietnamese trainees in the country. We equipped him with an instamatic camera. As he went through interviewing people, he took the instamatic and took the pictures. When he came back, he said, "I got most of what I want. Their penmanship is beautiful and I don't know how to photograph that kind of stuff. It didn't come out right." So, we sent the

Sergeant out to photograph those for him. The Captain had been working on it in the morning and he gave the script to the Sergeant at 11:00 in the morning. At two o'clock when he briefed the General one-third of the slides he had taken himself, one-third had been specifically taken for him, and one-third of his narrative slides were current as of 11:00 that morning. So, he was able to say, "General, this is what I want to tell you as of today." And there your briefing started to move. The cost of that was amazingly small. He used about 80 slides which cost about the same as two overheads.

The next way of doing a cost effectiveness study is on the location where you teach. If you pick a kid up at one base and transport him to another one, then you've got to include his transportation time, and his dead time waiting for the course, and his time. And that's a very expensive way to teach. Right now I am caught in a way that I don't know how to use a desk calculator that's on my desk. Now I'm not going back to college--another course statistic--to do it. In some way they can bring the training to me. The manual does not seem to be efficient in this particular case. But there's a number of cases where we can take the training to the man instead of bring the man to the training and make it much cheaper. We can update and keep current. So, both the mechanics and the situation can be investigated to find cost effectiveness ways.

There are some things that I don't think are too cost effective in doing studies. One of them a friend of mine just got through paying for--which delights me--was a study which proved pretty conclusively that movies are much more expensive than TV. And the reason is that when you make a movie, you've got to write a thing called a script and that takes a lot of time. But to make a TV tape, all you've got to do is play an old movie in your film chain and you've got it. Therefore, movies are more expensive than TV. That kind of study doesn't help me.

They also did a study where they found out they could make it more cost effective if they left out how to place long distance calls--the actual switchboard operation. If you left that internal objective out of the program, you could teach long distance operators more cheaply. There seems to be some advantage to having long distance operators being able to place long distance calls.

Another point I would like to mention is one of our biggest problems within the Air Force--I imagine that yours are the same--frankly, is the supply situation. How many of you can order a series of cassettes and get what you want through the Supply department? Or, do you have the same trouble where you ask for a 36-exposure roll and they send you a 20-exposure roll? You tell them you can't use it but they say the computer says they're identical. What are you

supposed to do? You can't make filmstrip on 20-exposure rolls. I think that supply is one of our biggest problems.

As I indicated before, when we do try to go to a cost effective single system, we end up with K-rations or pabulum which is not really good in a classroom.

Along the same line in cost effectiveness, I don't see any particular reason why a course can't be taught in a given way - merely because that's the way the instructor feels like teaching it. If you pay attention to individual differences in your students, why not pay attention to individual differences in your instructors? Some instructors can teach one way, some can teach another. Why force them on into the same mold?

Now, since this is the last presentation, I would like to reminisce just a little bit because, frankly, this comes in as of last night, I am getting scared. I took my present job nine years ago. My first major assignment was to fly into Washington for a briefing and go slightly south of it to a meeting. What they told me at that briefing and at that meeting was that a thing called programmed instruction is going to solve all my ills. It had one defect; namely, if you ever taught erroneous concepts, you could never undo it. They might be right but when I got down to this other meeting, I heard they had a projector that could branch between 10,000 items. They were going to check it out in a course called Electronics, at Keesler. I'm just here from a trip to Washington, nine years later, to another meeting south of Washington, nine years later. A week ago I was at a meeting where they are developing a machine that will branch 10,000 items. They are going to check it out at a place called Keesler, in a course called Electronics Fundamentals. They are now calling it systematizing instead of programming--the difference seems to be the amount of material on the page. The slides I used then indicated that in one of my first projects I used the Revere Sound on Slide. It's now called the 3M. It's the same device. Then I had trouble with projectors; yesterday I had trouble with projectors. Now what I want to summarize up is that if we're making so much progress and doing so good, how come we're back to where we were nine years ago?

Problems and Research Findings in Relation to Methods and Media Effectiveness and Cost Effectiveness of Media

**Discussion Leader: Mr. Richard S. Kneisel, Education Advisor,
United States Army Infantry School, Fort
Benning, Georgia**

Following the presentation by Dr. Edgar Smith, Air Force Human Resources Laboratory, Air Systems Command, Lowry AFB, Colorado, there was a discussion relative to research available in the area of cost effectiveness and on the entire aspect of media and method effectiveness.

The Westinghouse Learning Corporation Technical Report AFHRL-TR-69-30 (in two volumes) entitled "Analysis and Approach to the Development of an Advanced Multimedia Instructional System," authored by William F. Rhode, et al., was discussed. This report was developed for the Air Force Human Resources Laboratory. The study was an attempt to get at the fundamental problem of educational technology--that of finding ways to reduce significantly instructional costs while either maintaining or improving instructional effectiveness. This report purports to have developed a complex array and organization of a mass of information directly useful as a planning base for the design and functional specification of an advanced multimedia instructional system. The report includes a review and assessment of selected instructional media (to include portable instructional aids, TV, student response systems). Each medium is listed, described fully and carefully as to instructional flexibility requirements for support and initial and operational costs. Dial access, CAI, EVR, and branching teaching machines are fully explored.

Comparative analysis with respect to strengths and weaknesses of the devices and systems are included. An illustrative configuration which approaches the optimum is presented. This concept includes the use of a computerized managed training system.

Dr. Edgar Smith was quite familiar with this Westinghouse report and called attention to some of its shortcomings. He felt that many of the hidden costs in the media were not included and felt that there was a danger in using the report as an ultimate screening device. Dr. Smith also pointed out the danger of comparing, via the report, "apples and oranges;" that is, one device may be "cheaper" but not fill the instructional bill and hence a decision maker would be using the wrong criterion for selection. Too many times, Dr. Smith felt, individuals use a report such as this Westinghouse report in a vacuum outside of the concepts of the total training system or program.

Dr. Robert Seidel, HumRRO Division No. 1, Alexandria, Virginia, felt, however, that the Westinghouse report was not too bad in that it did offer a point of departure, did pull together a lot of information, and did make many people aware of devices, media, and methodology that would not have been otherwise known to them. The Westinghouse report, in short, serves as a useful tool and guide.

It was pointed out that media and methods become a part of the total instructional milieu and, accordingly, the book by Dr. Robert J. Smith, Jr., entitled The Engineering of Educational Training System (Heath-Lexington Books, D. C. Heath and Company, Lexington, Massachusetts, 1971) might be of assistance.

Several of the participants indicated that too many times the training manager is influenced by the "gadget concept" and not the effectiveness aspect of a given method or media. Accordingly, there must be efforts made to direct the manager to the cost benefits as opposed to purely the cost. Gadgets and gimmicks sometimes get in the way of good learning instead of helping the learning situation. Research is needed to look at total systems rather than bits of a system.

Dr. Edgar Smith, Lowry Air Force Base, stated that super 8mm projectors and the cassette TV are not standardized as yet and are in a sense in competition with each other. Accordingly, it would be well to hold off on these for a bit until more definitive data on the specific systems are available.

Dr. Leslie J. Briggs again emphasized that in considering the methods and media there must be a systems approach. The basic thrust of the learning situation must be considered. The methods and media become a part and parcel of the small chunks of learning objectives and must be viewed in the light of logical administrative real world practicality. The cost effectiveness comes into play in bringing the two ideas into balance.

LTC Robert Gerry, Headquarters US Air Force, Washington, D. C., felt that all must realize the necessity of being realistic about selection of media and the necessity of relying on interchange between all elements of the military establishment as well as between the military establishment and industry and the larger educational community.

There was, in summary, a consensus that there is no single pat answer for cost effectiveness. In a sense each method and media must be developed within each instructional system. Certain research and data can provide some guidelines and general help but in short what works for "your" organization may be the best criteria of effectiveness.

Summary of Sessions on Methods and Media

by

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Some ideas that developed from the four workshop sessions are as follows:

1. Media and methods must be considered an integral part of a total instructional system.
2. Role of the instructor is changing from that of a presenter of knowledge to that of a manager of instruction and consultant-advisor.
3. Some media and methods appropriate for one environment or instructional situation are not necessarily appropriate to all; however, experience and research can be a valuable tool in making decisions.
4. If educationist and media technicians do not have a mutual respect and understanding for each other in developing a system, ground rules need to be established before trying to work on the method and media development.
5. Simulators at the lower level training (EM) to cover a wider spectrum of the Army are needed.
6. Learning centers may give the impression of being only for remediation and enrichment when in fact they can be used for the total instructional program.
7. Research on a longitudinal basis is needed in methods and media.
8. There is a requirement to bring the learning situation to the learner at his local environment rather than transporting the learner to a central learning establishment such as a school.
9. Matrices can be used effectively in some aspects of course design (systems engineer).
10. Simulation and simulators provide a means for bringing a kind of realism into the training world.

11. Cost effectiveness of media may best be used in comparing different models of the same media rather than comparing one media with a completely different one.

12. Media should be associated with a learning objective that is specific; however, there is a requirement to balance real world costs and problems of administration with the media selection so that in a given period of time the media does not change so often as to be unmanageable.

13. Computers appear to be most effectively used in the management of instruction as opposed to tying up an expensive computer as a sophisticated page turner in the learning center.

14. Learning centers may provide a means for mastery learning (remediation) in the Basic Combat Training Centers and Advanced Individual Training Centers.

15. Learning centers offer the possibility of presenting college level and GED courses as well as a means for studying for MOS proficiency tests.

16. Media and/or methods must be thought of in connection with the kind of learning that is to take place as well as the "level" of the learner.